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ABSTRACT

This set of learning modules was developed during a project to deliver workplace literacy instruction to individuals employed in the more than 50 businesses related to the activities of the Port of Baltimore. It is intended to help employees of port businesses develop basic math skills. The following topics are covered in the individual modules: fractions and decimals, ratio and proportion, percent, powers and area, the Pythagorean theorem, the metric system, and metric conversions. The final module is a postassessment. Each module contains objectives, procedures, student handouts, and learning activities/grammar exercises. Answers to all problems/exercises are included. (MN)

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ED 381 655

THE PORT OF BALTIMORE WORKPLACE SKILLS DEVELOPMENT PROJECT

MARITIME MATH REVIEW

U.S. DEPARTMENT OF EDUCATION
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CE 068 753

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Course

Maritime Math Review is a course designed for office staff of the Port of Baltimore businesses, primarily customs brokerages. The course objectives are as follows:

- Familiarize students with concepts concerning percent;
- Give students practice in calculating percent;
- Familiarize students with concepts concerning area and volume;
- Give students practice in calculating area and volume:
- Teach students the Pythagorean Theorem;
- Give students practice in applying the Pythagorean Theorem to solve problems;
- Introduce students to the metric system;
- Give students practice in metric conversion and applying metric measures to problems related to their workplace.

The course was taught as eight modules of one and a half hours each, redesigned as requested by these businesses. The requirement for the Pythagorean Theorem is peculiar to certain brokerages, for example, not to all Port businesses.

Module 1 - Pre-Assessment and Review

Objective

1. To assess what knowledge students have concerning fractions, decimals, percentage, area and the metric system.

2. To review fractions and decimals.

Procedure

1. Students will take pre-assessment test.

2. Teacher will discuss strengths and weaknesses shown by pre-assessment with each individual.

3. Class will review principles of fractions and decimals, doing worksheets designed to refresh their memories, if necessary.

4. Class will do harder word problems with fractions and decimals, to show they can apply these skills.

Module 1 PRE-ASSESSMENT

1. 5% of 120 is _____

2. 75 is what % of 90? _____

3. Joyce paid $50 on a shipment. This was 5% of the total. What was the total?

   _____

4. A company is sending item A at $500, item B at $700, & item C at $535. If they're getting a $300 rebate, how will they prorate the rebate among items A, B, & C?

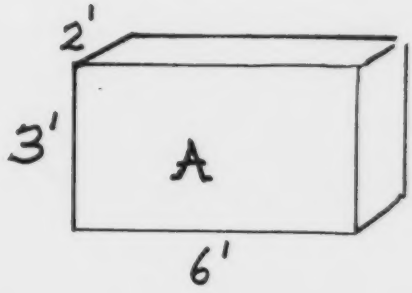
   A. _____

   B. _____

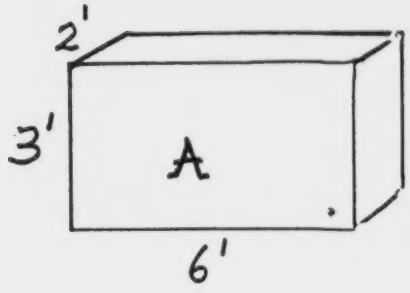
   C. _____

5. Find the area of side A of this figure.

   _____



6. Find the volume of this figure.



_____

7. A box measures 6 ft. by 8 ft. by 4 ft. and the government asks for the measurement of the diagonal of the largest side. What is it?

8. 5 m = _____cm

9. 1000 m = _____km

10. 8000 g= _____kg

11. A shipment of 3,000 kilograms is priced at $.75 per pound. One kilogram = 2.2046 pounds. What will it cost for this shipment?

_____

12. A shipment is 200 square meters in size, but the truck is measured in feet. If 1 ft. = 0.3048 m, what is the size of the shipment in square feet?

_____

FRACTION AND DECIMAL REVIEW - 1A

1. Reduce to lowest terms:

   3/9= 16/18= 35/49=

2. Raise to higher terms:

   $\frac{4}{5} = \frac{_}{30}$ $\frac{2}{3} = \frac{_}{21}$ $\frac{1}{3} = \frac{_}{45}$

3. Change to a whole or mixed number:

   14/8= 36/10= 42/9=

4. Change to an improper fraction:

   2 3/4= 2 9/10= 12 1/4=

5. Add:

9/24	7/8	4/9
7/24	+3/4	1/6
+2/24		+5/12

6. Subtract:

7 1/2	7 2/3	30 1/4
-2 1/4	-2 8/9	-16 5/12

7. Multiply:

   2/5 x 3/4 = 1 1/2 x 1/4 =

   3 3/4 x 8/4 x 1 1/5 =

8. Divide:

3/7 ÷ 2/5 = 4/5 ÷ 4 = 1 1/2 ÷ 3/4 =

9. Write each decimal as a fraction or a mixed number, and then reduce:

.08 = .375 = 7.22 =

10. Change to a decimal:

2/5 = 3/8 = 5/12 =

11. Arrange from smallest to largest:

.02 .705 .53 .8

12. Solve these problems:

.8 + .047 + .36 = 4.2 – 3.76 =

5 – 2.493 = .09 x .06 =

.5404 ÷ 28 =

Fraction Problem Solving 1B

1. One day Mark swept floors for 2 3/4 hours, earning $7.20 per hour. He also earned a flat fee of $35.00 for yardwork. How much more did he earn for the yard work than for the sweeping?

2. Alfredo's employer withholds 1/5 of his gross wages for federal tax, 1/8 for state tax, and 1/10 for social security. Alfredo's weekly gross pay is $360. What fraction of his gross wages does Alfredo take home?

3. How many dollars of Alfredo's salary is withheld each week for federal tax?

4. Alfredo spends 1/3 of his take-home pay for food. How much does he spend on food each week?

5. If 4 1/2 yards of material cost $41.40, what is the cost of one yard of the material?

6. From a ten-pound bag of flour Janina first took 3 1/2 pounds and then another 4 5/8 pound. How much flour was left?

7. Al cut a piece that was 3 1/4 feet long from a board that was 8 feet long. How long was the remaining piece?

8. Find the average weight, to the nearest tenth of a pound, of three packages that weigh 2 1/2 pounds, 5 3/4 pounds, and 6 1/3 pounds respectively.

9. Fran bought 3/4 pound of cheese for $2.50 a pound and 1 1/2 pounds of coffee for $3.90 a pound. What did she pay for these items?

10. Arrange in order from smallest to largest: 7/10, 4/5, 3/4, 13/20.

Decimal Problem Solving 1C

1. In 1990, the port shipped 6.79 million tons; by 1992 the tonnage had increased 3.39 million tons. What was the total tonnage in 1992?

2. David drove 223 miles on 12 gallons of gasoline. To the nearest tenth, find the average number of miles he drove on one gallon of gasoline.

3. The rate schedule below shows the hourly electricity costs for various household appliances. The Walek family has their television turned on for an average of 52 hours a week. How much do the Waleks pay each week to operate their television?

Electricity (cost per hour)	
iron	$.005
television	.034
clock	.010
radio	.022

4. All but 56.3 pounds of topsoil were sold at a sale. If the store began with 100 pounds of the topsoil and charged $.59 a pound, how much money did it make on this item?

5. The number of hits a baseball player gets is divided by the number of times he goes to bat to give his batting average. Last season Bill was at bat 75 times, and he made 22 hits. Find his batting average. Round off your answer to the nearest thousandth.

6. Arrange the following lengths of pipe in order from smallest to largest:

A --- 1.8 yard
B --- 0.75 yard
C --- 1.75 yard
D --- 0.125 yard
E --- 1.125 yard

7. Charlene bought 5 yards of 36-inch wide material for $7.80 a yard and 2.5 yards of 42-inch wide material for $8.40 a yard. How much did she pay altogether for the material?

8. The distance between Manny's workplace and his home is 3.6 miles one way. The distance between his home and his exercise class is three times that far for the round trip. If Manny drives to and from work five days a week, how much farther does he drive for work than he does for exercise class on Monday & Wednesday nights?

9. Pete does moving and hauling on the side. He charges $125 for small items and $190 for large ones. One month he did 5 small items and 3 large ones. How much did he make on moving that month?

10. Alfonso drove from El Paso to Dallas in 13 hours. Then he drove from Dallas to Houston in 4 hours. Finally he drove from Houston back to El Paso in 15.5 hours. Over the entire trip, Alfonso bough 70 gallons of gasoline at a cost of $1.38 per gallon. How many gallons of gas did Alfonso use on average per hour on this trip? Round to the hundredths place.

Module 2 - Ratio and Proportion

Objectives

1. To explain ratio and proportions, so that students may use them in many math problems but especially in percentage and pro-rating, both of which are necessary to Port of Baltimore businesses.

Procedures

1. Students will go over details of ratio and proportion.
2. Students will try word problems using proportions.
3. Class will discuss answers together.

Ratio and Proportion

A ratio is a comparison of two numbers.

It can be written 2 to I, 2:1, or 2/1. It should always be reduced; if the answer is 1 for the second number, the ratio should stay in the form using two numbers.

A proportion is made up of two equal ratios,

2:4 = 1/2 or 2/4 = 1/2 or $\frac{2}{4} = \frac{1}{2}$

It is vital to set up a proportion correctly. It helps to set up the fraction and label its parts in the exact order the problem gives.

> At Jane's work place, there are 4 defective parts allowed per every 1,000 made. If the night shift did 50,000 parts, how many defects were they allowed to have?
>
> $\frac{4 \text{ defects}}{1{,}000 \text{ parts made}} = \frac{?}{50{,}000 \text{ parts made}}$

You can find missing terms by cross multiplying, for example

> 4 x 50,000 = 1,000 x unknown number
>
> multiply 4 x 50,000 = 200,000 and **divide** by remaining number 1,000
>
> ANSWER IS 200 defective parts

Try these exercises:

m/6 = 10/15	1/3 = a/5
4:e = 6:8	8/7 = 4/x

(**Answers:** m = 4, a = 1.66 or 1 2/3, e = 5.33 or 5 1/3, x = 3.5)

Proportion Word Problems 2A

1. If 6 feet of wire cost $3.40, how much will 9 feet of wire cost?

2. The scale on a map says that 2 inches = 150 miles. If two cities are actually 325 miles apart, how far apart will they be on the map?

3. If 30 people send out 75 invoices a month, how many invoices will 50 people be able to do in a month?

4. How long will it take to go 1200 miles if a plane travels 450 miles in two hours?

5. To make a certain color for painting ships, the ratio of blue paint to white paint is 5:2. How many gallons of blue paint are required to mix with 14 gallons of white paint for this blend to be the right color?

6. On a certain bar graph, a line 2.5 inches long represents 75 ships unloaded per month. How many inches of bar are required to represent 110 ships unloaded in a month?

7. A worker can make 16 parts in 2 hours. How long does this worker need to make 100 of these same parts?

8. Cable clips cost $9 per dozen. How much should 8 clips cost?

Harder Proportion Problems - 2B

1. For every $10 Jane takes home, her employer withholds $3 for taxes and social security. Jane's gross pay each month is $1950. How much does she take home each month?

2. Jack's soccer team won 5 games for every 3 games they lost. Altogether the team played 32 games. How many games did they win?

3. The ratio of the number of men to the number of women working at the import company is 7:2. Altogether there are 360 workers at the company. How many of the workers are women?

4. The ratio of good parts to defective parts coming off the ship is 20:1. While this ship is in port, it unloads 10,500 parts. How many of these parts are defective?

5. Recently 300 people took the brokers' examination. For every five people who passed the examination, one person failed. How many people passed?

6. A ratio of the workers who voted to strike to the workers who voted not to strike at Eppot was 3:2. If 360 workers voted, how many were for the strike?

7. A ladder is placed against a building with one end 40 feet up from the ground. The bottom of the ladder is 13 feet out from the side of the building. If another ladder is placed against the building at the same angle and its top rests 20 feet from the ground, how far from the building will the bottom of the ladder be? (Hint: Set up a proportion comparing the height of the ladder to the distance on the ground.)

Module 3 - PERCENT

Objective:

1. To learn how percents work and the proportion method for manipulating them.
2. To use workplace situations to solve percent problems.
3. To apply these methods to pro-rating problems.

Procedure:

1. Participants will be shown the three forms of percent problems.
2. Participants will learn how to solve these problems using the proportion method.
3. Students will try pro-rating problems.

PERCENTS

Percents are another way of describing the parts of a whole. With percents, one whole is always divided into 100 parts.

To change a **percent to a decimal**, drop the percent sign and move the decimal point two places to the left.

18% = .18 250% = 2.50 = 2.5 1% = .01

To change a **decimal to a percent**, move the decimal point two places to the right and add a percent sign.

.46 = 46% 4.68 = 468% .0468 = 4.68%

Remember alphabetical order, D before P:

Decimal ☞ Percent .25 ☞ 25%

Percent ☜ Decimal 4% ☜ .04

To change a **fraction to a percent**, divide the denominator into the numerator. The answer is a decimal; then move the decimal point two places to the right:

3 ÷ 4 = .75, then .75 = 75%

To change a **percent to a fraction**, drop the percent sign and place the number over a denominator of 100, then reduce:

75% = 75/100 = 3/4

125% = 125/100 = 1 25/100 = 1 1/4

Try these exercises:

Change these fractions to percents 5/8 = 4/7 = 6/21 =

(**Answers** .625 = 62.5% and .5714 = 57.14% and .2857 = 28.57%)

Change these percents to fractions 60% 110%
(**Answers** 60/100 = 3/5) (110/100 = 1 1/10)

Change these percents to decimal 60% 110%
(**Answers** 60%=.60=.6) (110%=1.10=1.1)

6.5% 83 1/3%
(**Answers** 6.5%=6.5/100=.065=65/1000) (83 1/3% = 83.3/100 = .833= 833/1000)

1/4% O.1%
(**Answers** 1/4% =.25/100 =.0025 = 25/10,000) (0.1%=.1/100=.001=1/1000)

There are 3 kinds of percent problems, each missing one piece of information. Each one can be solved by setting it up as a proportion.

1. Finding the percent of a number given

   6 is what percent of 12?

   $\frac{6}{12} = \frac{x}{100}$

   6 x 100 = 600 ÷ 12

   X=50

   So 6 is <u>50%</u> of 12.

2. Finding what number is a certain percent of another number

   ___ is 50% of 12

   $\frac{x}{12} = \frac{50}{100}$

   50 x 12 = 600 ÷ 100 = 6

   x=6

   So <u>6</u> is 50% of 12.

3. Finding a number when the percent of it is given

   6 is 50% of ___

   $\frac{6}{x} = \frac{50}{100}$

   6 x 100 = 600 ÷ 50

   x=12

   So 6 is 50% of <u>12</u>.

Remember this formula for all percent problems:

$$\frac{\text{PART}}{\text{WHOLE}} = \frac{\%}{100}$$

6 = ? % of 12 $\qquad \frac{6}{12} = \frac{?\%}{100}$

What is 50% of 12 $\qquad \frac{?}{12} = \frac{50\%}{100}$

6 is 50% of what? $\qquad \frac{6}{?} = \frac{50\%}{100}$

Try these exercises:

9 is what percent of 36?
40 is what percent of 16?
120 is what percent of 160?
Find 30% of 90.
Find 300% of 60.
Find 16 2/3% of 72.
18 is 50% of what number?
90 is 4.5% of what number?
86 is 200% of what number?

(**Answers:** 25%, 250%, 75%, 27, 180, 12, 36, 2000, 43)

Student Activity 3A

DIRECTIONS: Set each problem up as a proportion first, and then work the problem.

1. 16 is what percent of 32?

2. Find 80% of 90.

3. 30 is 60% of what number?

4. What is 4 1/2% of 800?

5. What percent of 50 is 14?

6. 12 1/2% of what number is 15?

7. 15 is what percent of 45?

8. What is 3.6% of 900?

9. 120 is what percent of 80?

10. 33 1/3% of what number is 45?

11. What is 8.6% of 200?

12. 100% of 38.7 equals what?

13. The Maryland Port Authority's management team reduced the workforce by 15% for FY 1992, as a result of the struggling economy. If there were 479 employees at that time, how many were laid off?

14. Eleven cranes at Dundalk Marine Terminal operated 1084 hours one month. The downtime, or time not operating, was only 0.4% How many hours were the cranes not operating?

15. In 1992, the world demand for U.S. steel declined greatly. 91,254 tons moved through the Port of Baltimore in the first three quarters of 1992, as compared to 206,179 tons during the same period in 1991. What was the percent of decline?

16. Imports grew in 1992, even though exports declined. At the Maryland Port Authority imports increased 7%, to about 75,000 tons. What was the approximate 1991 import figure?

17. Container volume at the Maryland Port Authority in 1992 rose 1.4% from 1991, to 2,910,101 tons. How much of an increase in tons was this? (This problem requires two steps.)

18. Only 0.1% of the vehicles being unloaded by stevedores at the Port of Baltimore suffered any damage in January 1994. If 12,890 vehicles were unloaded, about how many were damaged in the process?

19. Smith Company sells their services for a 9% commission. In November their services were $3840 for one of their clients. How much did they make in commission in November from that client?

20. If containerized cargo at the Port of Baltimore rose 4.3% in 1993 to 4,073,080 short tons, what was the tonnage in 1992?

ADDITIONAL PERCENT PROBLEMS 3B

1. 1,210 people attended a concert last night. 242 had free tickets. What percent of the people who attended the concert had free tickets?

2. How much interest would be collected on $1200 at a 6 1/2% annual interest rate for a period of one year?

3. Retired employees of the Sable Corporation get a pension of 64% of the salary they were making when they retire. If a worker for the Corporation was making $21,520 a year when he retired, what will his yearly pension be?

4. The Dundalk Export Softball Team won 75% of its games this season. The team won 36 games. How many games did the team play?

5. Marilyn got a raise in salary from $11,500 to $13,915 a year. By what percent did her salary increase?

6. A small company took out a $10,000 loan. They will make monthly payments of $200 each for the next 10 years. What percent of the original loan will they pay in interest? (1 year = 12 months)

7. Joyce makes $189 a week. This is 80% of what her husband Ronald makes. How much does Ronald make a week?

8. In 1980, the average American ate 6.7 pounds of rice. In 1990 the average American ate about 9.5 pounds of rice. By what percent did the amount of rice eaten by the average American increase from 1980 to 1990? (Round off your answer to the nearest whole percent)

9. One year, 5% of the 4,140 students who graduated from Maryland High School joined the armed forces. How many students joined the armed forces that year?

10. Russell already has saved 34% of the money he needs to buy a new adding machine. He already has saved $74.80. What is the cost of the adding machine?

11. Of 24 new clients, 9 cancelled contracts. What percent of the new clients cancelled?

12. The price of paper went from $.75 a ream to $1.05 last week. By what percent did the price of paper increase?

Prorating

Use your knowledge of proportions and percents on problems like the following.

An employee of Universal Import is working on an invoice with 3 items at $500, $300, and $200, which total $1000. There has been a $150 reduction so the bill now totals $850. The employee needs to prorate the 3 items to take advantage of the reduction.

$$\frac{\$500}{\$1000} = \frac{n}{\$850}$$

So the $500 item is now prorated to $425.

$$\frac{\$\ 300}{\$1000} = \frac{n}{\$850}$$

So the $300 item is now prorated to $255.

$$\frac{\$\ 200}{\$1000} = \frac{n}{\$850}$$

So the $200 item is now prorated to $170.

The 3 new prorating figures, when added together, give a total of $850.

Student Activity 3C - Prorating

Invoice # 21:

Item J	$ 47,000
Item K	$ 6,000
Item L	$ 400
Item M	$+10,000
	$63,400
Reduced by	$ 4,000
	$59,400

How are Items J, K, L, and M prorated?

Invoice # 22:

Item X	$ 40,000.00
Item Y	$ 80,000.00
Item Z	+$110,000.00
	$230,000.00
Reduced by	3,816.42
	$226,183.58

How are Items X,Y, and Z prorated?

Invoice # 23:

Item D	$ 4,800.00
Item E	$ 6,100.00
Item F	+$ 9,600.00
	$20,500.00
Reduced by	$ 1,500.00
	$19,000.00

How are Items D, E, and F prorated?

Invoice # 24:

Item A	$ 20,000
Item B	$ 5,000
Item C	+$25,000
	$50,000
Reduced by 5%	_____

How are Items A, B, and C prorated?

Module 4 - Geometry
POWERS AND AREA

OBJECTIVE:

1. To develop a background in powers or exponents in order to work with area, volume and other geometric problems.

2. To use workplace situations to solve problems of area.

PROCEDURE:

1. Participants will work on powers with the instructor.

2. Participants will study a chart on numbers squared, roots, and numbers cubed. Participants will then complete problems, discussing with the instructor.

3. Participants will work on area problems.

4. Participants will do problems on mixed units of measurement and finding the area.

STUDENT ACTIVITY 4A - POWERS

The figure 5^2 is read as "five to the second power." The 5 is called the **base**. The 2 is called the **exponent**. The exponent tells how many times the base number is multiplied by itself in the problem.

RULE: Write the base as many times as the exponent indicates, and then multiply each number.

Examples: $5^2 = 5 \times 5 = 25$
$4^3 = 4 \times 4 \times 4 = 64$

A number to the second power is called the square of a number.
A number to the third power is called the cube of a number.

DIRECTIONS: Find the value of each.

1. 6^2
2. 1^3
3. 5^3
4. $(3/5)^2$
5. 3^5
6. $5^2 + 3^2$
7. $5^3 - 10^2$
8. $(.06)^2$
9. 25^2
10. $11^2 - 4^3$
11. $(.005)^2$
12. 20^3
13. $(1/4)^3$
14. 10^4
15. 2^6

SQUARES, ROOTS, CUBES

SQUARED	ROOTS	CUBED
$1^2 = 1$	$\sqrt{1} = 1$	$1^3 = 1$
$2^2 = 4$	$\sqrt{4} = 2$	$2^3 = 8$
$3^2 = 9$	$\sqrt{9} = 3$	$3^3 = 27$
$4^2 = 16$	$\sqrt{16} = 4$	$4^3 = 64$
$5^2 = 25$	$\sqrt{25} = 5$	$5^3 = 125$
$6^2 = 36$	$\sqrt{36} = 6$	$6^3 = 216$
$7^2 = 49$	$\sqrt{49} = 7$	$7^3 = 343$
$8^2 = 64$	$\sqrt{64} = 8$	$8^3 = 512$
$9^2 = 81$	$\sqrt{81} = 9$	$9^3 = 729$
$10^2 = 100$	$\sqrt{100} = 10$	$10^3 = 1000$
$11^2 = 121$	$\sqrt{121} = 11$	$11^3 = 1331$
$12^2 = 144$	$\sqrt{144} = 12$	$12^3 = 1728$
$13^2 = 169$	$\sqrt{169} = 13$	$13^3 = 2197$
$14^2 = 196$	$\sqrt{196} = 14$	$14^3 = 2744$
$15^2 = 225$	$\sqrt{225} = 15$	$15^3 = 3375$
$20^2 = 400$	$\sqrt{400} = 20$	$20^3 = 8000$
$50^2 = 2500$	$\sqrt{2500} = 50$	$50^3 = 125000$
$100^2 = 10{,}000$	$\sqrt{10{,}000} = 100$	$100^3 = 1{,}000{,}000$

SQUARE ROOTS- 4B

A square root is a number inside a division box that looks like this: $\sqrt{36}$

The root is the number which can be multiplied by itself to give the answer inside the square root box. So the square root of 36 is 6 because 6 x 6 = 36.

Use the chart to find the square roots in the following problems.

You can estimate the approximate root of the number from the chart. For example, $\sqrt{1225}$ is less than 50^2 but larger than 20^2. 30 x 30 will be too small and 40 x 40 will be too large. So the root is somewhere between 30 and 40. Since the number ends in the digit 5, and since the only root which gives 5 for an answer is 5 x 5, our first guess will be 35 x 35.

And we are right! 35^2 is 1225, so the square root of 1225 is 35. Notice that we write 35 for the answer, NOT 35^2.

1. $\sqrt{1849}$ =

2. $\sqrt{3364}$ =

3. $\sqrt{4624}$ =

4. $\sqrt{6241}$ =

5. $\sqrt{7396}$ =

6. $\sqrt{9604}$ =

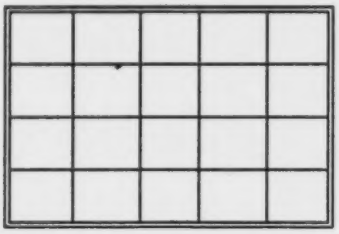
Not all square root problems come out to a whole number for their root. The following two problems can be rounded off to two decimal places. Of course, this is much easier to do on a pocket calculator or a calculating machine than to do with pencil and paper.

7. $\sqrt{845}$ =

8. $\sqrt{10}$ =

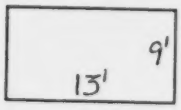
STUDENT ACTIVITY 4C- AREA

The formula for the area of a rectangle is A = LW. L stands for length and W stands for width; two letters side by side tell you to multiply. Area is the entire surface covered by an object as if it were counted off in even rows and columns of square inches, or square feet or whatever is the measure used.
Example: What is the area of the figure to the right?
It is 5 x 4 = 20 feet (or inches) square.

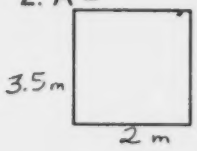


Area problems can also be done in reverse. The area formula is used when the area is given, plus one side, so that you have to find the length or width of the missing side. Take the area given and DIVIDE it by the length or width given. The answer is the missing side. **Example**: What is the width of a rectangle that has an area of 48 square yards and a length of 12 yards? 48 ÷ 12 = 4 so the width is 4 yards.

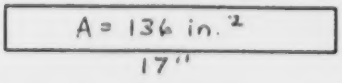
1. A = _____



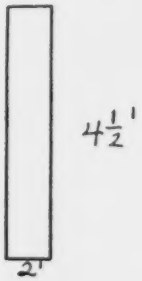
2. A =



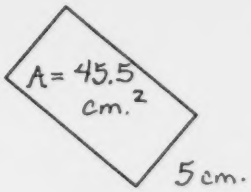
3. S = _____



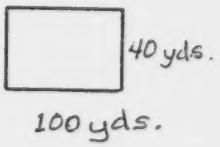
4. A = _____



5. S = _____



6. A = _____



7. Tom found that an available space in the warehouse measures 5 yards long and 4 1/2 yards wide. How many square yards is this?

8. How many square feet of tile are needed to put a new tile surface on a Dundalk Marine Terminal floor that measures 32 feet by 20 feet?

9. The label on a gallon of interior wall paint reads: "Coverage: 400 square feet". If a wall is 8 feet high, what is the maximum length of wall that can be painted with 1.5 gallons of this paint?

10. The bottom of a box measures 11 inches long by 8 1/2 inches wide. Is the area of the bottom larger than 100 square inches?

11. A window measures 2 1/4 feet high and 4 feet wide. How many square feet of glass will be needed to replace the window after it got broken?

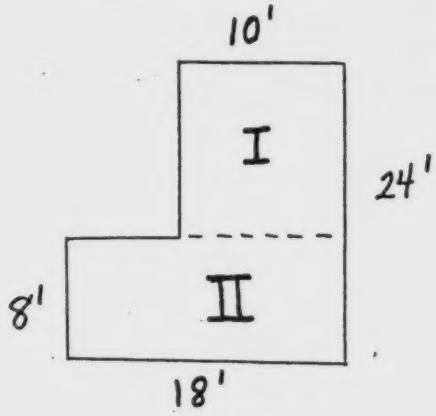
12. Find the width of a warehouse that has an area of 6,000 square meters and a length of 120 meters.

4D - COMPLEX AREAS

Many area problems involve figures that are a combination of common geometrical shapes. They are two-step problems. In order to solve them, you must divide the figure into shapes that have formulas and then solve for each shape separately.

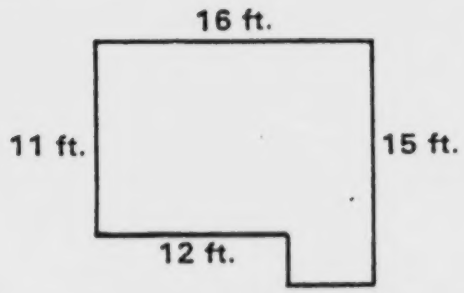
Find the area of the figure at the right.

1. Divide the figure into 2 rectangles.
2. Label the rectangles I and II.
3. We do not know the second dimension of the top rectangle.
   It must be 24 - 8 = 16,
   so the top rectangle is 10 x 16.
4. Find the area of each rectangle.
   Area of I = 16 x 10 = 160 sq. ft.
   Area of II = 18 x 8 = 144 sq. ft.
5. Add the areas of the 2 rectangles.
   160 sq. ft. + 144 sq. ft. = 304 sq. ft.

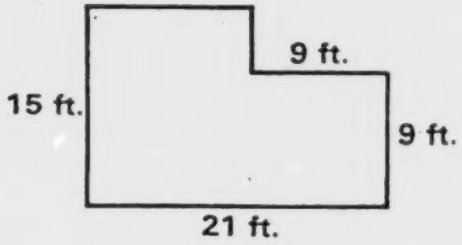


DIRECTIONS: Find the area of each shape.

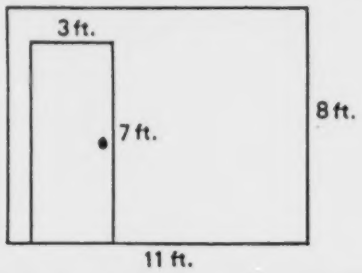
1. A = _____



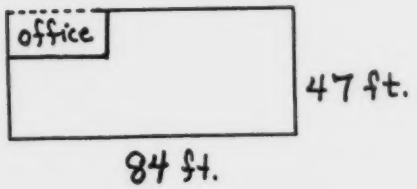
2. A = _____



3. How many square feet of wallpaper will be needed to cover the wall pictured below?



4. How many square feet of the warehouse can be used for storage if the office is 15 feet wide and 20 feet long?



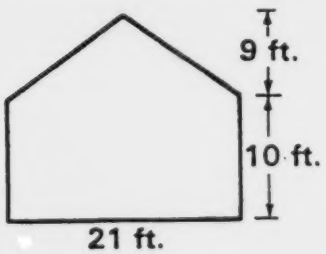
The following problems may require other formulas. The class can discuss the triangle formula, the circle formula and the trapezoid formula before attempting these problems.

Triangle:
$A = 1/2\ BH$

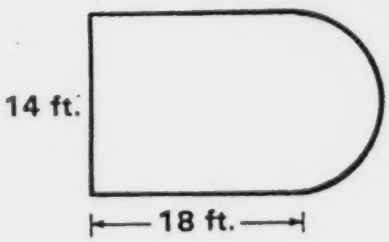
Circle:
$A = \pi R^2$
($\pi = 3.14$)

Trapezoid:
$A = 1/2(B_1 + B_2)H$

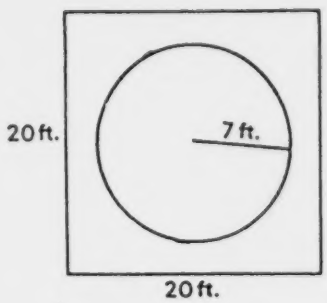
5. A = _____
(Hint: This shape involves a rectangle and a triangle.)



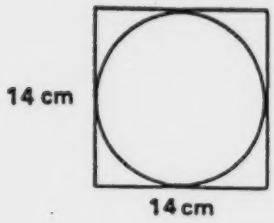
6. A = _____
(Hint: This shape involves a rectangle and a half of a circle.)



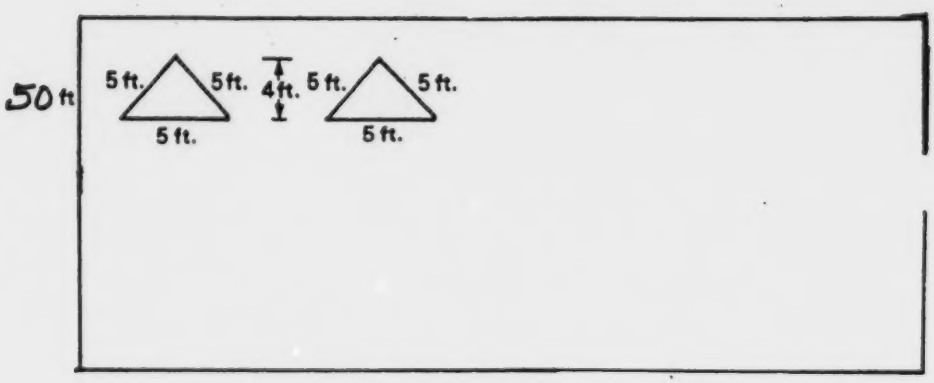
7. The Port wants to put asphalt around a circular holding tank. How many square feet of asphalt will be needed?



8. A container repairman wants to cut a circular piece from a square piece of steel. How many square centimeters of steel will not be used?



9. There are 2 triangular shapes planted with flowers in the Port parking area. Excluding the garden area, how many square feet of parking does the area cover?



ACTIVITY 4E - AREA WITH MIXED UNITS OF MEASUREMENT

Directions: Use the following information to solve these problems.

1 sq. ft. = 12 x 12 = 144 sq. in.
1 sq. yd. = 3 x 3 = 9 sq. ft.
1 acre (A) = 4840 sq. yd.
1 sq. mi. = 640 square acres
(found by multiplying 1760 yards per mile by 1760, then dividing by 4840)

1. To change square inches to square feet, divide by _____.

2. 432 square inches equal how many square feet? _____.

3. To change square feet to square yards, divide by _____.

4. 27 square feet equal how many square yards? _____.

5. To change square yards to square feet, multiply by ____.

6. 4 square yards equal how many square feet? _____.

7. To change square yards to acres, divide by _____.

8. 121 square yards equal how many acres? _____.

9. A section of the warehouse has the dimensions of 70 feet by 30 feet. How many square yards are there in the floor area?

10. Find the cost of crates measuring 3 1/4 yards long by 1 1/2 yards wide, at $4.50 per square yard.

11. Tile was put on the office floor at a cost of $10.50 per square yard. The floor measures 18 feet by 14 feet. What was the cost?

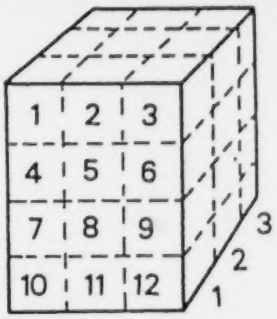
12. The company had the entrance rug cleaned at $.40 a square foot. The rug measures 9 feet by 12 feet. What did the cleaning cost?

13. The entrance, in the problem above, measures 13 feet by 16 feet. How many square feet of floor are **not** covered by the rug.

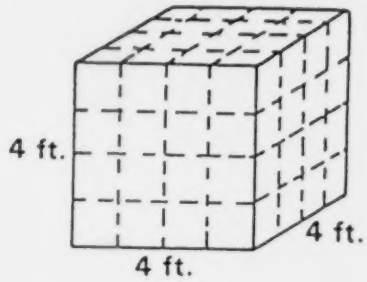
14. We bought a new carpet at a cost of $10 per square yard to cover a floor measuring 54 feet by 42 feet. What did we pay for this carpet?

VOLUME

Volume is a measure of space taken up by a solid figure, made up of volume units in the shape of cubes. By counting cubes in one layer, you can find the volume. Count the cubes in one layer and see that there are 12. There are 3 layers, so 3 x 12 = 36 cubes. This is a geometry formula: Volume = LWH, where L is length, W is width, and H is height. The three numbers are multiplied together to give the volume in units cubed.



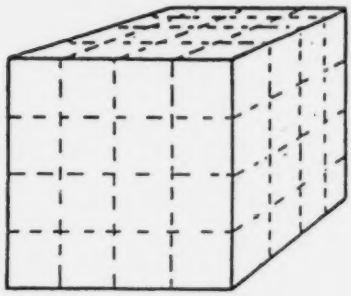
The volume is 36 units cubed.



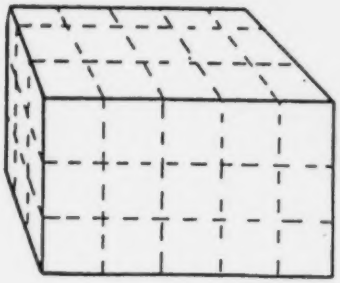
The volume is 64 units cubed.

4F Try these exercises using V = LWH.

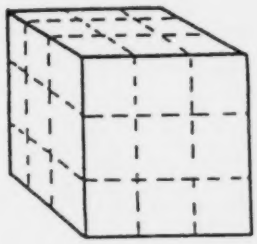
1. V = _____ cubic units



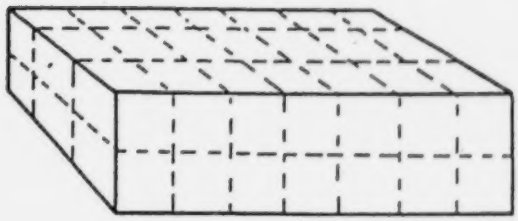
2. V = _____ cubic units



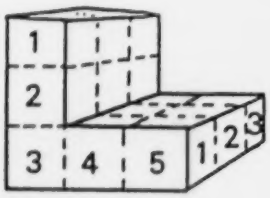
3. V = ____ cubic units



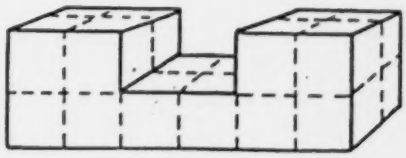
4. V = _____ cubic units



5. V = ____ cubic units



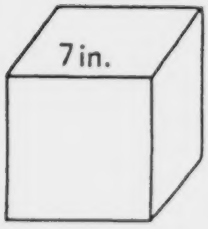
6. V = ____ cubic units



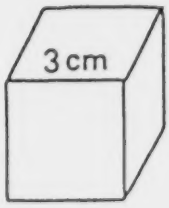
STUDENT ACTIVITY 4G - VOLUME

The next 3 items are perfect cubes with equal sides.

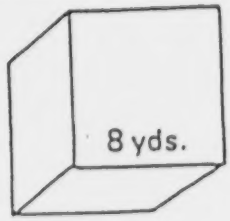
1. V = _____



2. V = _____



3. V = _____



4. An import company needs to store containers that are in the shape of a cube, with each side measuring 0.5 yard. If the warehouse space measures 18 yards by 18 yards by 18 yards, how many containers can be stored there?

5. A warehouse covers 500,000 square feet. If it has a ceiling 42 feet high, how many cubic feet will the warehouse hold?

6. Some containers for shipping measure 40 feet by 20 feet by 8 feet. If a ship arrives with 425 of these containers, how many cubic feet are being transported?

7. Maersk Line caters to all cargoes, even offering 45 foot high dry and refrigerated cube containers. If 215 of these cubes are loaded, what is their total volume ?

8. Office Supplies, Inc. makes Roladex boxes that are 6 inches x 4 inches x 3 inches. How many Roladexes can be put in a mailing box that measures 24 inches x 54 inches x 30 inches?

9. A 20 foot regular ocean container has an inside measurement of 7 ft 8 in x 19 ft 4 in x 7 ft 10 in. What is the volume of eight of these containers? (HINT: change feet and inches to decimals first. Carry decimals two places.)

10. A 40 foot reefer ocean container measures 37 ft 8.5 in x 7 ft 3.5 in x 7 ft 1.5 in. How many cubic yards is this? (HINT: change feet and inches to decimals first. Carry decimals two places.)

Module 5 - Pythagorean Theorem

OBJECTIVE:

1. To learn the Pythagorean Theorem.
2. To solve problems from workplace situations which use this formula.

PROCEDURE:

1. Participants will review their understanding of powers and right triangles.
2. Participants will practice the Pythagorean Theorem.
3. Participants will solve word problems based on the theorem.

The Pythagorean Theorem

The side opposite the right angle, in a right triangle, is called the hypotenuse. Pythagoras, a Greek mathematician, found a formula that expresses the length of the hypotenuse of a right triangle. His formula says that the square of the hypotenuse in a right triangle equals the sum of the squares of the lengths of the other two sides. This relationship is called the Pythagorean Theorem.

Here is the formula: $a^2 + b^2 = c^2$ when a and b are the sides of a right triangle and c is the hypotenuse of a right triangle.

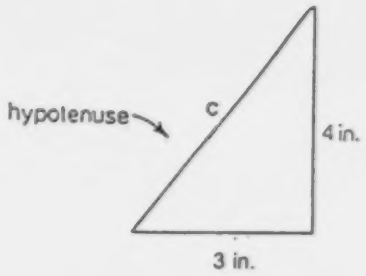
Here is how to use the formula:

Step 1. Substitute 3 for a and 4 for b.

$3^2 + 4^2 = c^2$

$9 + 16 = c^2$

$c^2 = 25$



Step 2. Find c.

$c^2 = 25$

$\sqrt{25} = 5$

Answer: length of hypotenuse = 5

Sometimes the Pythagorean Theorem is used to find the length of one side of a right triangle when the hypotenuse is already known.

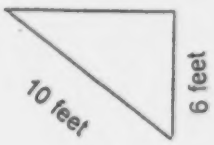
Find the length of the unlabeled side in this triangle.

Step 1. Substitute 10 for c and 6 for a.

$c^2 = a^2 + b^2$

$10^2 = 6^2 + b^2$

$100 = 36 + b^2$



Step 2. Subtract 36 from 100, according to the rules of equations.

$100 - 36 = 64$

$64 = b^2$

$\sqrt{64} = b$

$8 = b$

Answer: length of unlabeled side = 8 inches

5A - PYTHAGOREAN THEOREM

If you draw a picture of a right triangle and label its parts, you will find these problems easier to do.

1. The two sides of a right triangle measure 6 feet and 8 feet. What is the length of the hypotenuse?

2. The hypotenuse of a right triangle is 15 inches long. If one side measures 12 inches, what is the length of the other side?

3. Bill loaded a container measuring 5 yards by 12 yards at floor level. How long was its diagonal?

4. A ladder leans against the side of the house. The length of the ladder is 17 feet. The base of the ladder is out 8 feet from the side of the house. How far off the ground is the top of the ladder?

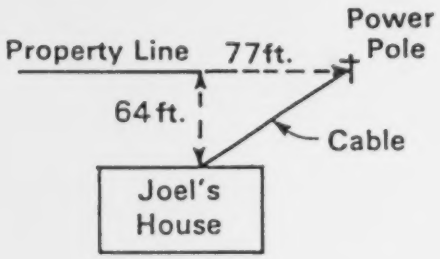
5. A box for shipment measures 5 feet by 7 feet on its largest side. Find the approximate length of the hypotenuse of this side.

6. After a ship sails 10 miles west and 7 miles north of the harbor, approximately how far is the ship from the harbor?

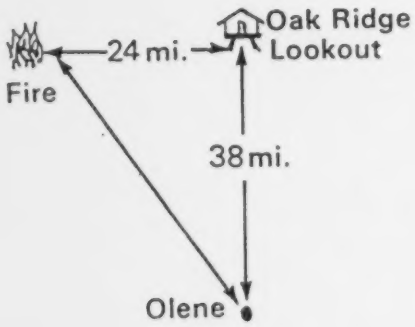
5B - PYTHAGOREAN THEOREM

Round off your answers to the nearest whole number.

1. A power company employee is going to run a power line from the power pole to the back of Joel's house. Use the drawing at the right, and determine the approximate length of cable the employee will need.



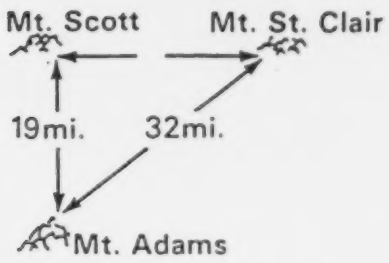
2. A forest ranger at Oak Ridge Lookout spotted a fire 24 miles west of his location. If the town of Olene is 38 miles due south, how far is Olene from the fire?



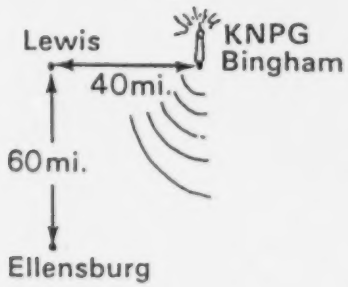
3. A container arrives that needs a diagonal measurement for a government form. The container's largest side is 16 feet by 43 feet. What is the diagonal measurement?

4. A carton measuring 120 cm by 154 cm needs the diagonal measurement. Round it off to the nearest whole number.

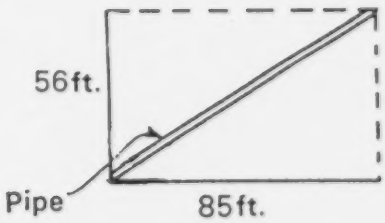
5. Bill Adams wants to hike directly from Mt. Scott to Mt. St. Clair. In mountain terrain, he can average about one mile for each hour he hikes. Use the map below to estimate how long it will take Bill to hike between the two mountains.



6. Radio station KNPG in Bingham has a broadcast range of 70 miles. Refer to the drawing below. Is Ellensburg within the broadcast range of KNPG?

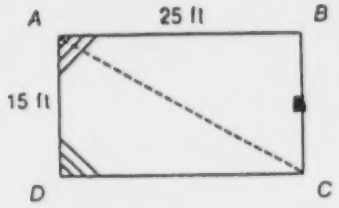


7. Ada Smith wants to put an underground sprinkler system in her back yard. One side of her rectangular yard measures 56 ft. and the other side measures 85 ft. If the sprinkler must be put in as the longest diagonal possible across the yard, what length of pipe will she need for the system?



5C - Mixed Problems

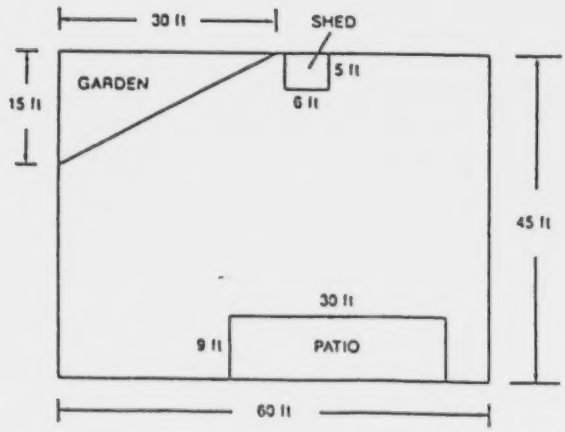
1. What is the approximate distance in feet from corner A to corner C of the warehouse space ?



2. According to the directions on the can, a gallon of wall paint holds 32 cubic inches of liquid and will cover 400 square feet of surface. With no waste, what is the maximum length in feet of an 8-foot-high wall that can be painted with three gallons of this paint?

3. The inside dimensions of a truck are as follows: length = 25 feet; width = 10 feet; height = 8 feet. What is the maximum number of boxes, each measuring 48 inches, by 24 inches, by 12 inches, that can be placed in this truck?

Questions 4, 5, and 6 are related to the following drawing. As indicated by the drawing below, the Robinson family has a garden, a shed, and a patio in their back yard. The rest of the back yard is planted in grass.

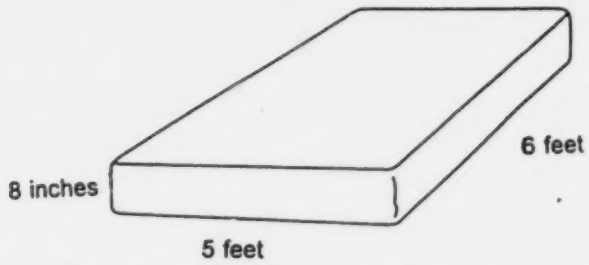


4. What is the ratio of
the area of the patio
to the area of the garden?

5. What percent of the area of the Robinson's back yard is used for the patio?

6. How many square feet of the back yard are planted in grass?

7. Knowing that one cubic foot is equal to about 7.5 gallons, what is the approximate number of gallons of water that can be held in this water bed?



8. A company wants to send out some boxes which measure 65 cm long, by 100 cm wide, by 55 cm high. If there are 86 boxes and the cost of shipping is $4.25 per cubic meter, what is the cost of this shipment?

9. The Wilson Sugar Company packs sugar cubes in boxes that measure twelve centimeters on a side. If each sugar cube measures one centimeter on a side, how many cubes can be placed in each box?

10. One side of a square measures 8.5 meters. A rectangle with the same area as the square has a length of 18 meters. How many meters wide is the rectangle?

Module 6 - Introduction to Metrics

Objective:

1. To introduce the metric system, in linear, weight and capacity measurements.
2. To explain the connection between metric prefixes and their numerical values.
3. To check participants' understanding of the metric system using a metrical version of Jeopardy.

Procedure:

1. Instructor will explain the metric system, its uses, its vocabulary, its basis in the decimal system.
2. Participants will practice metric equivalents on a worksheet.
3. Instructor will explain method to change measurement from larger to smaller units and from smaller to larger units.
4. Participants will practice changing measurements on a worksheet.
5. Participants will put what they have learned into practice by answering questions about what is reasonable in the measurement system, mathematically speaking.
6. Instructor will quiz participants on their understanding of the metric system using a version of the Jeopardy game.

The Metric System

In the metric system, meters are used to measure space.
In the U.S. system, inches, feet, yards and miles are used to measure space.
In the metric system, grams are used to measure weight.
In the U.S. system, ounces, pounds and tons are used to measure weight.
In the metric system, liters are used to measure liquid.
In the U.S. system, cups, pints, quarts and gallons are used to measure liquid.

Who uses the metric system? Every country in the world EXCEPT the United States.

1 kilometer (km) = 1000 meters

1 hectometer (hm) = 100 meters

1 dekameter (dkm) = 10 meters

1 meter

1 decimeter (dm) = 1/10 of a meter or .1 meter

1 centimeter (cm) = 1/100 of a meter or .01 meter

1 millimeter (mm) = 1/1000 of a meter or .001 meter

The conversion factors in the metric system are 10 and the multiples of 10 (100, 1,000, and so on). The metric system is like the U.S. monetary system, because it is a decimal system based on multiples of 10.

The prefixes in front of the different measures are ALWAYS used the same way:

kilo-	means one thousand or 1,000
hecto-	means one hundred or 100
deka-	means ten or 10
deci-	means one-tenth, 0.1, or 1/10
centi-	means one-hundredth, 0.01, or 1/100
milli-	means one-thousandth, 0.001, or 1/1,000

Example: A kilometer is a metric unit used to measure length.
kilo- means 1,000
meter is the basic unit
A kilometer equals 1,000 meters.

Example: A milligram is a metric unit used to measure weight.
milli- means 1/1000
gram is the basic unit
A milligram is 1/1000 of a gram.

Exercise 6A

Try using the prefixes to help you to fill in the blanks.

1. A kiloliter equals _____ liters.
2. A dekameter equals _____ meters.
3. A centigram equals _____ of a gram.
4. A millimeter equals _____ of a meter.
5. A hectoliter equals _____ liters.
6. A decimeter equals _____ of a meter.
7. A kilogram equals _____ grams.
8. A milliliter equals _____ of a liter.
9. A dekagram equals _____ grams.
10. A centimeter equals _____ of a meter.

STUDENT ACTIVITY 6B - METRICS

Look at the three lists below and fill in the blanks as the teacher displays items for each one. This will help to get a tangible grasp on the size of each unit of measurement.

Or try to fill in the blanks with everyday objects which are measured by the words given. For example, a kilometer is used to measure a marathon race.

METER	**LITER**	**GRAM**
kilometer (km)	kiloliter (kl)	kilogram (kg)
_____	_____	_____
meter (m)	liter (l)	gram (g)
_____	_____	_____
centimeter (cm)	centiliter (cl)	centigram (cg)
_____	_____	_____
millimeter (mm)	milliliter (ml)	milligram (mg)
_____	_____	_____

Possible answers:

speed limit sign	***bathtub***	***boxes of bananas***
size of room	***soda bottle***	***1 paper clip***
width of large paper clip	***can of soda***	***strands of hair***
width of a pen point	***medicine dosage***	***grains of sand***

TABLES OF MEASUREMENT

METRIC

Length
1 kilometer = 1000 meters
1 meter = 100 centimeters or 1000 millimeters
1 centimeter = 1/100 of a meter or 10 millimeters
1 millimeter = 1/1000 of a meter

Weight
1 metric ton = 1000 kilograms
1 kilogram = 1000 grams
1 gram = 1000 milligrams

Capacity
1 kiloliter = 1000 liters
1 liter = 1000 milliliters

U.S. STANDARD

Length
1 foot (ft.) = 12 inches (in.)
1 yard (yd.) = 36 inches
1 yard = 3 feet
1 mile (mi.) = 5,280 feet
1 mile = 1,760 yards

Weight
1 pound (lb.) = 16 ounces (oz.)
1 ton = 2000 pounds

Capacity
1 pint (pt.) = 2 cups
1 quart (qt.) = 2 pints
1 gallon (gal.) = 4 quarts
1 peck (pk.) = 8 quarts
1 bushel (bu.) = 4 pecks

STUDENT ACTIVITY 6C

Changing units from the smaller size to the larger size, S → L DIVIDE

Changing units from the larger size to the smaller size, L ← S MULTIPLY

L → S	S → L
x	÷

Try these using the table for U.S. Standard Measurements

1. 4 quarts = _____ pints
2. 5 gallons = _____ quarts
3. 300 minutes = _____ seconds
4. 5 hours = _____ minutes
5. 6 days = _____ hours
6. 6 weeks = _____ days
7. 4 years = _____ weeks
8. 2 years = _____ days
9. 10 feet = _____ inches
10. 15 yards = _____ feet
11. 10 miles = _____ feet
12. 16 pints = _____ quarts
13. 12 quarts = _____ gallons
14. 300 seconds = _____ minutes
15. 150 minutes = _____ hours
16. 54 hours = _____ days
17. 22 days = _____ weeks
18. 500 days = _____ years
19. 30 inches = _____ feet
20. 36 feet = _____ yards
21. 2640 feet = _____ miles

Student Activity 6D

Try the following using the table for Metric Measurements
Part I

kilometer (km)
hectometer (hm)
dekameter (dkm)
meter (m)
decimeter (dm)
centimeter (cm)
millimeter (mm)

1. 5 m = _____ cm
2. 4 dm = _____ m
3. 24 dm = _____ m
4. 150 dm = _____ dkm
5. 7 km = _____ hm
6. 600 cm = _____ m
7. 3 hm = _____ dkm
8. 3 m = _____ dm
9. 70 cm = _____ dm
10. 300 hm = _____ km
11. 2 km = _____ dkm
12. 1.5 km = _____ m
13. 50 cm = _____ mm
14. 1 m = _____ mm
15. 2,000 mm = _____ m

Part II

kilogram (kg)
hectogram (hg)
dekagram (dkg)
gram (g)
decigram (dg)
centigram (cg)
milligram (mg)

1. 30 cg = _____ dg
2. 6 kg = _____ g
3. 400 mg = _____ dg
4. 5 kg = _____ hg
5. 500 dg = _____ g
6. 850 dkg = _____ kg
7. 14 g = _____ cg
8. 56 hg = _____ kg
9. 4 kg = _____ dkg
10. 5.25 kg = _____ g

Part III

kiloliter (kl)
hectoliter (hl)
dekaliter (dkl)
liter (l)
deciliter (dl)
centiliter (cl)
milliliter (ml)

1. 50 cl = _____ dl
2. 250 ml = _____ cl
3. 1,600 cl = _____ l
4. 25 dkl = _____ l
5. 43 hl = _____ l
6. 3 kl = _____ dkl
7. 6,500 l = _____ kl
8. 7 dl = _____ ml
9. 20,000 l = _____ dl
10. 5.5 l = _____ ml (please note this does NOT say 5.51)

STUDENT ACTIVITY 6E

What is Most Reasonable?

Let's assume a kilometer is about 6/10 of a mile.
Let's assume a centimeter is about the width of a paper clip.
Let's assume a meter is about a yard.
Let's assume a liter is about 2 quarts.
Let's assume a gram is the weight of one paper clip.

Find the most reasonable linear metric measure:

a. Distance from house to local grocery: 200 km, 2 km, or 2 m ?
Answer: 2km (Remember that 1 km is about 6/10 of a mile, so 2 km is a little more than a mile.)

b. Width of a light bulb: 3 m, 6 cm, or 2 mm ?
Answer: 6 cm (6 cm is about the width of 3 buttons next to each other on a push-button phone.)

c. Height of a teacher: 1/2 km, 2 m, or 6 cm ?
Answer: 2 m (1 m is about a yard, so 2 m is about 2 yards or 6 feet.)

Try these: Find the most reasonable measure.

1. Width of a pencil: 8 mm, 1/4 km, or 3 cm ?
2. Length of a living room: 10 dm, 6 m, 100 cm?
3. Height of an oak tree: 5 cm, 3 km, or 40 m ?
4. Altitude of a jet plane: 8 km, 3 mm, or 1/2 m ?

Answers: 1.) 8 mm 2.) 6 m 3.) 40 m 4.) 8 km

Find the most reasonable metric measure for capacity in each case:

a. The capacity of a large coffee mug: 1 kl, 1/2 l, 1 ml ?
Answer: 1/2 l (1 l is about 1 quart; 1/2 l is about 1 pint)

b. A bath oil bead (size of a marble): 3 dkl, 14 l, 2 ml
Answer: 2 ml (3 dkl and 14 l are both larger than 1 liter)

Try these: Find the most reasonable measure.

5. The capacity of a cooking pot: 5 cl, 1 kl, or 2 l ?

6. The capacity of a bathtub: 500 ml, 1/2 kl, 5 l ?

Find the most reasonable metric measure for weight for each case:

a. A piece of typing paper: 5 kg, 3 g, or 1 mg ?
Answer: 3 g

b. A small car: 1000 g, 1000 kg, or 100 mg ?
Answer: 1000 kg

Try these: Find the most reasonable metric measure.

7. A pocket calculator: 50 g, 4 mg, or 2 kg ?

8. A brick: 2 kg, 30 g, 500 mg ?

Answers: 5.) 2 liters 6.) 1/2 kiloliter 7.) 50 g 8.) 2 kg

Introduction to Metrics - 6F

SINGLE JEOPARDY GAME

PTS.	METERS	LITERS	GRAMS	MISCELLANEOUS
10	km = ?m	kl = ?l	1000 mg = ?g	Metric prefixes that all mean 1/10, 1/100, 1/1000 of the base unit, all end in what letter?
20	3 cm = ? mm	1 l = ? ml	1000 g = ?kg	Metric prefixes that mean 100 or 1000 end in what letter?
30	3000 mm = ?m	7 kl = ? l	15,000 mg = ?g	The metric unit of measure for weight is what?
40	4500 m = ?km	15 l = ?cl	2 kg = ?g	The metric unit of measure for liquid is what?
50	20 cm = ?mm	20,000 l = ?kl	56 g = ?mg	The width of your hand is closer to 11 cm or 1/2 m?

SINGLE JEOPARDY ANSWERS

PTS.	METERS	LITERS	GRAMS	MISCELLANEOUS
10	km = 1000 meters	kl = 1000 liters	1000 mg = 1 gram	Metric prefixes that all mean 1/10, 1/100, 1/1000 of the base unit, all end in what letter? i
20	3 cm = 30 millimeters	1 l = 1000 milliliters	1000 g = 1 kilogram	Metric prefixes that mean 100 or 1000 end in what letter? o
30	3000 mm = 3 meters	7 kl = 7000 liters	15,000 mg = 15 grams	The metric unit of measure for weight is what? the gram
40	4500 m = 4.5 kilometers	15 l = 1500 cehtiliters	2 kg = 2000 grams	The metric unit of measure for liquid is what? the liter
50	20 cm = 200 millimeters	20,000 l = 20 kiloliters	56 g = 56,000 milligrams	The width of your hand is closer to 11 cm or 1/2 m? 11 cm

DOUBLE JEOPARDY GAME

PTS.	METERS	LITERS	GRAMS	MISCELLANEOUS
100	1 cm = ? m	60,000 ml = ? l	12 g = ? mg	The length of a car is closer to 75 cm or 5 m?
200	18 km = ? m	1500 kl = ? l	10 mg = ? cg	The weight of a cracker is closer to 20 g or 20 mg?
300	95 mm = ? cm	6500 l = ? kl	6500 g = ? kg	The weight of a 5# bag of sugar is closer to 20 g or 2 kg?
400	500 m = ? km	5.5 l = ? ml	7500 cg = ?g	The average coffee mug holds closer to one fourth l or 40 ml?
500	1 km = ? mm	Which is more: 15 kl or 16,000 liters?	A metric ton equals ? kg.	A child's plastic wading pool holds closer to 2 kl or 200 l of water when full?

DOUBLE JEOPARDY GAME ANSWERS

PTS.	METERS	LITERS	GRAMS	MISCELLANEOUS
100	1 cm = 1/100 m	60,000 ml = 60 liters	12 g = 12,000 milligrams	The length of a car is closer to 75 cm or 5 m? 5 meters
200	18 km = 18,000 m	1500 kl = 1,500,000 l	10 mg = 1 cg	The weight of a cracker is closer to 20 g or 20 mg? 20 g
300	95 mm = 9.5 cm	6500 l = 6.5 kl	6500 g = 6.5 kg	The weight of a 5# bag of sugar is closer to 20 g or 2 kg? 2 kg
400	500 m = .5 km	5.5 l = 5,500 ml	7500 cg = 75 g	The average coffee mug holds closer to one fourth liter or 40 ml? one fourth liter
500	1 km = 1,000,000 millimeters	Which is more: 15 kl or 16,000 liters? 16,000 l	A metric ton equals 1000 kg.	A child's plastic wading pool holds closer to 2 kl or 200 l of water when full? 2 kl

Module 7 - METRIC CONVERSIONS

OBJECTIVE:

1. Participants will learn how to use a conversion chart for metric to standard measurement, and standard to metric measurement.

2. Participants will learn to use conversions in word problems.

Procedure:

1. Participants will practice these conversions and complete work-related problems.

Standard - Metric Conversion Table

To change	to	Multiply by
centimeters (cm)	feet	0.03281
centimeters (cm)	inches	0.3937
cubic centimeters (cu.cm)	cubic inches	0.0610
cubic feet (cu.ft.)	cubic meters	0.0283168
cubic inches (cu.in.)	cubic centimeters	16.3870
cubic meters (cu.m)	cubic feet	35.3133
cubic meters (cu.m)	cubic yards	1.3079
cubic yards (cu.yd)	cubic meters	0.76
feet (ft.)	centimeters	30.48
feet (ft.)	meters	0.3048
gallons (gal.)	liters	3.7853
grams (g)	ounces	0.0353
grams (g)	pounds	0.002205
inches (in.)	meters	0.0254
inches (in.)	centimeters	2.54
inches (in.)	millimeters	25.4
kilograms (kg)	pounds	2.2046
kilometers (km)	miles	0.6214
liters (l)	gallons	0.2642
liters (l)	pints	2.1134
liters (l)	quarts	1.0567
long ton (2240 lbs)	metric ton	1.02
meters (m)	inches	39.37
meters (m)	feet	3.2808
meters (m)	miles	0.0006214
meters (m)	yards	1.0936
metric ton	ton	1.102
miles (mi.)	kilometers	1.6093
millimeters (mm)	inches	0.0394
ounces (oz.)	grams	28.3495
pints (pt.)	liters	0.4732
pounds (lb.)	grams	453.6
pounds (lb.)	kilograms	0.453592
pounds (lb.)	metric ton	0.0004536
quarts (qt.)	liters	0.9463
short ton (2000 lb)	metric ton	0.9
square centimeters (sq.cm)	square inches	0.16
square feet (sq.ft.)	square meters	0.0929
square inches (sq.in.)	square centimeters	6.5
square meters (sq.m)	square feet	10.7636
square meters (sq.m)	square yards	1.2
square yards (sq.yd.)	square meters	0.8
yards (yd.)	meters	0.9144

STUDENT ACTIVITY 7A - METRIC CONVERSIONS

Directions: Convert these measurements using the chart above. You may use a calculator. Round off the answer to a whole number.

1. 2.65 ft = _____ cm
2. 34.5 in = _____ cm
3. 419 qt = _____ liters
4. 97 pt = _____ liters
5. 14.75 oz = _____ g
6. 5.7 lb = _____ g
7. 1500 m = _____ yd
8. 528 cm = _____ ft
9. 22 liters = _____ gal
10. 183 liters = _____ qt
11. 546.7 g = _____ lb
12. 325.8 g = _____ oz

STUDENT ACTIVITY 7B
METRIC CONVERSIONS

Directions: Convert each measurement and round the answers to two decimal places.

1.	14 in =	cm	2.	40 km =	mi
3.	100 lb =	kg	4.	6 l =	qt
5.	3.2 oz =	g	6.	140 cm =	in
7.	8 mi =	km	8.	27 l =	gal
9.	50 in =	m	10.	920 g =	lb
11.	90 ft =	m	12.	200 m =	ft
13.	106 qt =	l	14.	454 g =	oz
15.	3.61 lb=	g	16.	500 kg =	lb
17	40 qt =	l	18.	7.25 m =	in
19.	400 lb =	kg	20.	8 oz =	g
21.	15 l =	qt	22.	8 gal =	l
23.	80 m =	ft	24.	330 g =	oz
25.	36 ft =	m	26.	3.7 m =	in
27.	289 km =	mi	28.	72 in =	cm
29.	935 cm =	ft	30.	12 l =	pt

31. In 1993 general cargo moving through five marine terminals in Baltimore increased to 5,423,471 short tons. How many metric tons was this?

32. Six boxes occupy 1.2 square meters each. How many square yards is this for all 6 boxes?

33. Cars that are ready for export must be moved 800 meters to the ship. How many miles is this to the nearest tenth?

34. The U.S. legal gross weight limit on a 40 foot container is 80,000 lbs. The tractor, empty container, and chassis weigh 33,000 lbs. If a shipment is 21,152 kg, will it be within the weight limit?

35. An imported car from Japan has a gas tank with a 52 liter capacity. How many gallons of gas will the tank hold?

36. Conowingo Dam on the Susquehanna River is 14 miles upstream from the Bay. How many kilometers is that?

37. A ship unloads 75 metric tons of iron ore. This is how many short tons?

38. 1.8 million metric tons of fish are harvested annually in water within three miles of the coast. How many pounds is this?

39. If a warehouse has 20 foot high ceilings, and a piece of machinery needs to be stored that is 6 meters high, will it fit?

40. A forklift has a 35,000 pound capacity. Will a driver be able to move a 15,242 kilogram container with it?

Metric Word Problems 7C

1. Company 1 is shipping 4500 pineapples. 2000 weigh 20 ounces each, 500 weigh 25 ounces each, and 2000 weigh 32 ounces each. What is the weight of the shipment in kilograms?

2. Company 2 is shipping 100,000 ounces of mushrooms, drained. What is the weight of the shipment in kilograms?

3. Company 3 is shipping 40,000 gallons of Miller's Lite Beer.

A. How many ounces is this?
B. How many liters?
C. If each gallon weighs 10.75 pounds, what is the weight of the shipment in pounds?
D. What is the weight in kilograms?

4. Company 4 ships 400 sheets of glass that are 6 feet x 8 feet each. How many square meters of glass are in this shipment?

5. Company 5 has a shipment of 20 panels that are 600mm x 200mm x 20mm each.
   A. What do all the panels total in cubic meters?
   B. If the inside dimensions of the container are 7.6 feet x 7.6 feet x 39.5 feet, will the 20 panels fit in the container?

6. Company 6 is shipping 500 boxes of Ritzo, which each measure 3 feet on each side. What is the volume of the boxes in meters? What is the volume in centimeters?

7. Company 7 ships 1000 boxes of Brand X wine, each containing 150 liters.
   A. The IRS wants to know how many gallons this is.
   B. The tariff schedule charges a $10 tariff per 1,000 liters. What is the charge for this shipment?

Module 8 POST-ASSESSMENT

OBJECTIVE:

1. Participants will review a list of formulas learned in this course.

2. Participants will take a post assessment test covering the mathematics reviewed in this course to show how much they have improved since the pre-assessment test.

PROCEDURE:

1. Participants will study the formulas which follow.

2. Participants will take the following Post-Assessment Test.

3. As class, participants will note own scores and discuss answers.

FORMULAS TO REMEMBER FROM MATH REVIEW

Percent Formula: $\frac{\text{Part}}{\text{Whole}} = \frac{\%}{100}$

Area and Volume Formulas:

Area of a rectangle or square = length x width
$A = LW$

Area of a circle = pi x radius squared
$A = \pi r^2$

Area of a triangle = half the base x height
$A = \frac{1}{2}bh$

Volume of a rectangular shape or a cube = length x width x height
$V = LWH$

Volume of a cylinder = pi x radius squared x height
$V = \pi r^2 h$

Square and Cubic Conversions:
1 square foot = 144 square inches
1 square yard = 9 square feet
1 cubic foot = 1728 cubic inches
1 cubic yard = 27 cubic feet

Pythagorean Theorem: $a^2 + b^2 = c^2$

Use when you need to find the long side (hypotenuse) of a right triangle, or the diagonal of a rectangular shape.

Metrics:

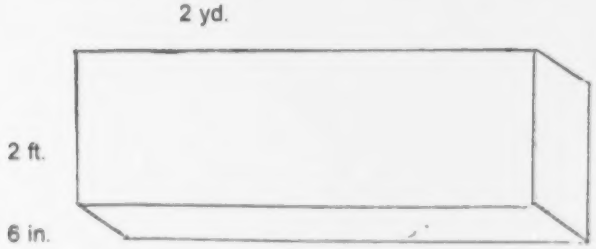
kilo is 1,000
hecto is 100
deka is 10
METER GRAM LITER
deci is 1/10
centi is 1/100
milli is 1/1000

Change a larger measure to a smaller measure: multiply (x)
Change a smaller measure to a larger measure: divide (÷)

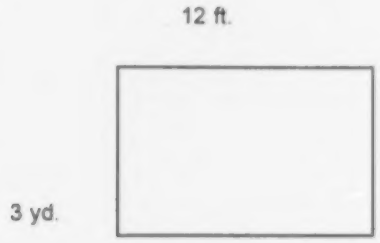
STUDENT ACTIVITY 8 - POST-ASSESSMENT TEST

1. The price of an answering machine was 15% off in a sale. If the original price was $69.99, what was the sale price of the machine? What was the final price if the tax in this state was 5%? (2 answers needed)

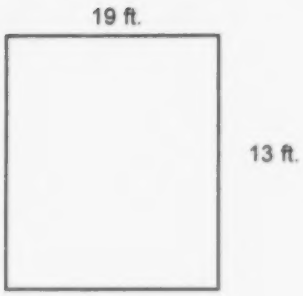
2. What is the volume of the box below in cubic feet?



3. The cost of the tile to cover this floor is $16.50 per square foot. How much will a new floor cost?



4. What is the diagonal of this rectangle to the nearest whole number?



5. A shipment is priced at $.50 per pound. If 2,500 kilos need to be sent, what will this shipment cost? (kilogram to pounds, multiply by 2.2046)

6. A shipment is 500 square meters in size. The truck used to transport it is measured in feet. What is the size of the shipment in square feet? (square meters to square feet, multiply by 10.7636)

7. Company Q is sending item A valued at $400, item B valued at $600, and item C valued at $500. If the company is given a $200 rebate, how will the company reassign the cost to items A, B, and C to keep the prices proportional?

Maritime Math Review Answers

By
Kathryn Janiszewski
and
Cathy Permut

Pre-Assessment Answers

1. 5% of 120 is 6

2. 75 is what % of 90? 83.3%

3. Joyce paid $50 on a shipment. This was 5% of the total. What was the total?

   $1000

4. A company is sending item A at $500, item B at $700, & item C at $535. If they're getting a $300 rebate, how will they prorate the rebate among items A, B, & C?

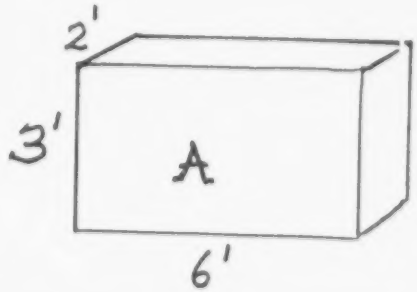
   A = $413.54 found by doing $\frac{500}{1735} = \frac{x}{1435}$

   B = $578.96 found by doing $\frac{700}{1735} = \frac{x}{1435}$

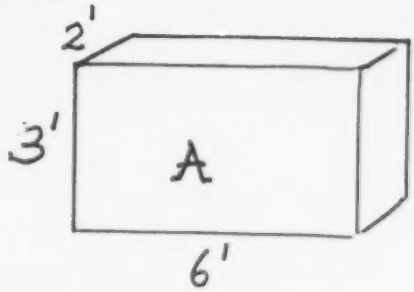
   C = $442.49 found by doing $\frac{535}{1735} = \frac{x}{1435}$

5. Find the area of side A of this figure.

   18 sq.ft. (3 x 6)



6. Find the volume of this figure. 36 cu.ft. (2 x 3 x 6)



7. A box measures 6 ft. by 8 ft. by 4 ft. and the government asks for the measurement of the diagonal of the largest side. What is it? 10 ft.

$6^2 + 8^2 = 100, \sqrt{100} = 10$

8. 5m = 500 cm

9. 1000m = 1 km

10. 8000g = 8 kg

11. A shipment of 3,000 kilograms is priced at $.75 per pound. One kilogram = 2.2046 pounds. What will it cost for this shipment? $4,960.35

3000 x 2.2046 x .75 = 4960.35

12. A shipment is 200 square meters in size, but the truck is measured in feet. If 1 ft. = 0.3048 m, what is the size of the shipment in square feet?

To answer this question, you must understand that 1 foot square is 0.3048 times 0.3048 = .092903; divide this number into 200 = 2,152.85 sq.ft.

the proportion is $\frac{1 \text{ ft. sq.}}{.092903} = \frac{x}{200}$

Fraction and Decimal Review- 1A ANSWERS

1.	1/3	8/9	5/7
2.	24/30	14/21	15/45
3.	1 3/4	3 3/5	4 2/3
4.	11/4	29/10	49/4
5.	3/4	1 5/8	1 1/36
6.	5 1/4	4 7/9	13 5/6
7.	3/10	3/8	9
8.	1 1/14	1/5	2
9.	2/25	3/8	7 11/50
10.	.4	.375	.41666
11.	.02, .53, .705, .8		
12.	1.207	.44	
	2.507	.0054	
	.0193		

Fraction Problem Solving 1B Answers

1. One day Mark swept floors for 2 3/4 hours, earning $7.20 per hour. He also earned a flat fee of $35.00 for yardwork. How much more did he earn for the yard work than for the sweeping? **7.2 x 2.75 = 19.10, 35.00 - 19.10 = $15.90**

2. Alfredo's employer withholds 1/5 of his gross wages for federal tax, 1/8 for state tax, and 1/10 for social security. Alfredo's weekly gross pay is $360. What fraction of his gross wages does Alfredo take home? **taxes are 17/40, take home pay is 23/40**

3. How many dollars of Alfredo's salary is withheld each week for federal tax? **1/5 x $360 = $72**

4. Alfredo spends 1/3 of his take-home pay for food. How much does he spend on food each week? **23/40 x $360 = 207 x 1/3 = $69**

5. If 4 1/2 yards of material cost $41.40, what is the cost of one yard of the material? **$9.20 (which is 41.10 ÷ 4.5)**

6. From a ten-pound bag of flour Janina first took 3 1/2 pounds and then another 4 5/8 pound. How much flour was left? **3 1/2 + 4 5/8 = 8 1/8 from 10 leaves 1 7/8 pound.**

7. Al cut a piece that was 3 1/4 feet long from a board that was 8 ft. long. How long was the remaining piece? **8 - 3 1/4 = 4 3/4 ft.**

8. Find the average weight, to the nearest tenth of a pound, of three packages that weigh 2 1/2 pounds, 5 3/4 pounds, and 6 1/3 pounds respectively. **2 1/2 + 5 3/4 + 6 1/3 = 175/12 ÷ 3 = 4 31/36 or 4.9 lb. average**

9. Fran bought 3/4 pound of cheese for $2.50 a pound and 1 1/2 pounds of coffee for $3.90 a pound. What did she pay for these items? **(.75 x 2.50 = 1.875) + (1.5 x 3.9 = 5.85) = $7.73**

10. Arrange in order from smallest to largest: 7/10, 4/5, 3/4, 13/20. **change all items to fractions with 20 as denominator and correct numerator; the order is then 13/20, 7/10, 3/4, 4/5**

Decimal Problem Solving 1C Answers

1. In 1990, the port shipped 6.79 million tons, by 1992 the tonnage had increased 3.39 million tons. What was the total tonnage in 1992?
3.39 + 6.79 = 10.18

2. David drove 223 miles on 12 gallons of gasoline. To the nearest tenth, find the average number of miles he drove on one gallon of gasoline.
223 ÷ 12 = 18.6 miles per gallon

3. The rate schedule below shows the hourly electricity costs for various household appliances. The Walek family has their television turned on for an average of 52 hours a week. How much do the Waleks pay each week to operate their television? **.034 x 52 = $1.768 = $1.77**

Electricity (cost per hour)	
iron	$.005
television	.034
clock	.010
radio	.022

4. All but 56.3 pounds of topsoil were sold at a sale. If the store began with 100 pounds of the topsoil and charged $.59 a pound, how much money did it make on this item? **100 - 56.3 = 43.7 x .59 = $25.78**

5. The number of hits a baseball player gets is divided by the number of times he goes to bat to give his batting average. Last season Bill was at bat 75 times, and he made 22 hits. Find his batting average. Round off your answer to the nearest thousandth. **22 ÷ 75 = .293**

6. Arrange the following lengths of pipe in order from smallest to largest:

A --- 1.8 yard
B --- 0.75 yard
C --- 1.75 yard
D --- 0.125 yard
E --- 1.125 yard

Correct order is D, B, E, C, A

7. Charlene bought 5 yards of 36-inch wide material for $7.80 a yard and 2.5 yards of 42-inch wide material for $8.40 a yard. How much did she pay altogether for the material? **5 x 7.80 + 2.5 x 8.40 = $60.00**

8. The distance between Manny's workplace and his home is 3.6 miles one way. The distance between his home and his exercise class is three times that far for the round trip. If Manny drives to and from work five days a week, how much farther does he drive for work than he does for exercise class on Monday & Wednesday nights? **3.6 x 2 = 7.2 x 5 = 36.0 mi.**

3.6 x 3 = 10.8 x 2 = 21.6

36.0 - 21.6 = 14.4 miles farther

9. Pete does moving and hauling on the side. He charges $125 for small items and $190 for large ones. One month he did 5 small items and 3 large ones. How much did he make on moving that month?
(5 x 125 = 625) + (3 x 190 = 570) = $1195

10. Alfonso drove from El Paso to Dallas in 13 hours. Then he drove from Dallas to Houston in 4 hours. Finally he drove from Houston back to El Paso in 15.5 hours. Over the entire trip, Alfonso bough 70 gallons of gasoline at a cost of $1.38 per gallon. How many gallons of gas did Alfonso use on average per hour on this trip? Round to the hundredths place.
13 + 4 + 15.5 = 32.5 70 ÷ 32.5 = 2.153 rounded to 2.15

Proportion Problems 2A ANSWERS

1. If 6 feet of wire cost $3.40, how much will 9 feet of wire cost? **$5.10**
   the proportion is $\frac{6}{3.40} = \frac{9}{x}$

2. The scale on a map says that 2 inches = 150 miles. If two cities are actually 325 miles apart, how far apart will they be on the map? **4 1/3 inches**
   the proportion is $\frac{2}{150} = \frac{x}{325}$

3. If 30 people send out 75 invoices a month, how many invoices will 50 people be able to do in a month? **125 invoices**
   the proportion is $\frac{30}{75} = \frac{50}{x}$

4. How long will it take to go 1200 miles if a plane travels 450 miles in two hours?
   5 1/3 hours the proportion is $\frac{450}{2} = \frac{1200}{x}$

5. To make a certain color for painting ships, the ratio of blue paint to white paint is 5:2. How many gallons of blue paint are required to mix with 14 gallons of white paint for this blend to be the right color? **35 gallons**
   the proportion is $\frac{5}{2} = \frac{x}{14}$

6. On a certain bar graph, a line 2.5 inches long represents 75 ships unloaded per month. How many inches of bar are required to represent 110 ships unloaded in a month? **3 2/3 inches**
   the proportion is $\frac{2.5}{75} = \frac{x}{110}$

7. A worker can make 16 parts in 2 hours. How long does this worker need to make 100 of these same parts? **12.5 hours**
   the proportion is $\frac{16}{2} = \frac{100}{x}$

8. Cable clips cost $9 per dozen. How much should 8 clips cost? **$6.00**
   the proportion is $\frac{9}{12} = \frac{x}{8}$

Harder Proportions 2B ANSWERS

1. For every $10 Jane takes home, her employer withholds $3 for taxes and social security. Jane's gross pay each month is $1950. How much does she take home each month? **$1500**, this is found by using 10 + 3 = 13 to set up the following proportion: $\frac{\$10 \text{ take home}}{13 \text{ total}} = \frac{x}{1950}$

2. Jack's soccer team won 5 games for every 3 games they lost. Altogether the team played 32 games. How many games did they win? **20 games**
   the proportion is $\frac{5}{8} = \frac{x}{32}$

3. The ratio of the number of men to the number of women working at the import company is 7:2. Altogether there are 360 workers at the company. How many of the workers are women? **80 women** the proportion is $\frac{2}{9} = \frac{x}{360}$

4. The ratio of good parts to defective parts coming off the ship is 20:1. While this ship is in port, it unloads 10,500 parts. How many of these parts are defective? **500 parts** the proportion is $\frac{1}{21} = \frac{x}{10{,}500}$

5. Recently 300 people took the brokers' examination. For every five people who passed the examination, one person failed. How many people passed?
   250 people passed the proportion is $\frac{5}{6} = \frac{x}{300}$

6. A ratio of the workers who voted to strike to the workers who voted not to strike at Eppot was 3:2. If 360 workers voted, how many were for the strike?
   216 workers the proportion is $\frac{3}{5} = \frac{x}{360}$

7. A ladder is placed against a building with one end 40 feet up from the ground. The bottom of the ladder is 13 feet out from the side of the building. If another ladder is placed against the building at the same angle and its top rests 20 feet from the ground, how far from the building will the bottom of the ladder be? (Hint: Set up a proportion comparing the height of the ladder to the distance on the ground.) **6 1/2 or 6.5 feet**
   the proportion is $\frac{40}{13} = \frac{20}{x}$

Student Activity ANSWERS 3A

DIRECTIONS: Set each problem up as a proportion first, and then work the problem.

1.	16 is what percent of 32?	50%
2.	Find 80% of 90.	72
3.	30 is 60% of what number?	50
4.	What is 4 1/2% of 800?	36
5.	What percent of 50 is 14?	28%
6.	12 1/2% of what number is 15?	120
7.	15 is what percent of 45?	33 1/3%
8.	What is 3.6% of 900?	32.4
9.	120 is what percent of 80?	150%
10.	33 1/3% of what number is 45?	135
11.	What is 8.6% of 200?	17.2
12.	100% of 38.7 equals what?	38.7

13. The Maryland Port Authority's management team reduced the workforce by 15% for FY 1992, as a result of the struggling economy. If there were 479 employees at that time, how many were laid off? **72 employees**

14. Eleven cranes at Dundalk Marine Terminal operated 1084 hours one month. The downtime, or time not operating, was only 0.4%. How many hours were the cranes not operating? **4.3 hours**

15. In 1992, the world demand for U.S. steel declined greatly. 91,254 tons moved through the Port of Baltimore in the first three quarters of 1992, as compared to 206,179 tons during the same period in 1991. What was the percent of decline? **55.74%** the proportion is $\frac{114,925}{206,179} = \frac{x}{100}$

16. Imports grew in 1992, even though exports declined. At the Maryland Port Authority imports increased 7%, to over 75,000 tons. What was the 1991 import figure? **70,093 tons** the proportion is $\frac{75,000}{x} = \frac{107\%}{100}$

17. Container volume at the Maryland Port Authority in 1992 rose 1.4% from 1991, to 2,910,101 tons. How much of an increase in tons was this? **40,179 tons**
the proportion is $\frac{2,910,101}{x} = \frac{101.4}{100}$ which gives 2,869,922

next, subtract 2,869,922 from 2,910,101, which equals 40,179

18. Only 0.1% of the vehicles being unloaded by stevedores at the Port of Baltimore suffered any damage in January 1994. If 12,890 vehicles were unloaded, about how many were damaged in the process? **12.89 or 13 vehicles** 12,890 x 0.1 = 12.89 or $\frac{x}{12,890} = \frac{0.1}{100}$

19. Smith Company sells their services for a 9% commission. In November their services were $3840 for one of their clients. How much did they make in commission in November from that client? **$345.60**
3840 x .09 or $\frac{x}{3840} = \frac{9}{100}$

20. If containerized cargo at the Port of Baltimore rose 4.3% in 1993 to 4,073,080 short tons, what was the tonnage in 1992? **3,905,158.1 short tons**

the proportion is $\frac{4073080}{x} = \frac{104.3\%}{100\%}$

ADDITIONAL PERCENT PROBLEMS ANSWERS 3B

1. 1,210 people attended a concert last night. 242 had free tickets. What percent of the people who attended the concert had free tickets? **20%**

2. How much interest would be collected on $1200 at a 6 1/2% annual interest rate for a period of one year? **$78**

3. Retired employees of the Sable Corporation get a pension of 64% of the salary they were making when they retire. If a worker for the Corporation was making $21,520 a year when he retired, what will his yearly pension be? **$13,772.80**

4. The Dundalk Export Softball Team won 75% of its games this season. The team won 36 games. How many games did the team play? **48 games**

5. Marilyn got a raise in salary from $11,500 to $13,915 a year. By what percent did her salary increase? **21%**

6. A small company took out a $10,000 loan. They will make monthly payments of $200 each for the next 10 years. What percent of the original loan will they pay in interest? (1 year = 12 months) **140%**

   200 x 12 x 10 = 24,000 amount repaid - 10,000 original loan = 14,000

   proportion is $\frac{14{,}000}{10{,}000} = \frac{x\ \%}{100}$

7. Joyce makes $189 a week. This is 80% of what her husband Ronald makes. How much does Ronald make a week? **$236.25**

8. In 1980, the average American ate 6.7 pounds of rice. In 1990 the average American ate about 9.5 pounds of rice. By what percent did the amount of rice eaten by the average American increase from 1980 to 1990? **41.79 ≈ 42%**

9. One year, 5% of the 4,140 students who graduated from Maryland High School joined the armed forces. How many students joined the armed forces that year? **207 students**

10. Russell already has saved 34% of the money he needs to buy a new adding machine. He already has saved $74.80. What is the cost of the adding machine? **$220.00**

11. Of 24 new clients, 9 cancelled contracts. What percent of the new clients cancelled? **37.5%**

12. The price of paper went from $.75 a ream to $1.05 last week. By what percent did the price of paper increase? **40%**

3C- Prorating ANSWERS

Invoice # 21: How are Items J, K, L, and M prorated?

$44,034.70 $\frac{47{,}000}{63{,}400} = \frac{x}{59{,}400}$

$ 5,621.45 $\frac{6{,}000}{63{,}400} = \frac{x}{59{,}400}$

$ 374.76 $\frac{400}{63{,}400} = \frac{x}{59{,}400}$

$ 9,369.09 $\frac{10{,}000}{63{,}400} = \frac{x}{59{,}400}$

Invoice # 22: How are Items X, Y, and Z prorated?

X = $39,336.27, Y = $78,672.55, Z = $108,174.76

Invoice # 23: How are Items D, E, and F prorated?

D = $4,448.78, E = $5,653.66, F = $8,897.56

Invoice # 24: How are Items A, B, and C prorated?

One way to do this problem is to find 5% of 50,000 first. Or you may find 5% of each item and subtract.

A = $19,000, B = $ 4,750, C = $23,750

4A ANSWERS

1. 6 x 6 = 36
2. 1 x 1 x 1 = 1
3. 5 x 5 x 5 = 125
4. 3/5 x 3/5 = 9/25 or .36
5. 3 x 3 x 3 x 3 x 3 = 243
6. (5 x 5 = 25) + (3 x 3 = 9) = 34
7. (5 x 5 x 5 = 125) - (10 x 10 = 100) = 25
8. .06 x .06 = .0036
9. 25 x 25 = 625
10. (11 x 11 = 121) - (4 x 4 x 4 = 64) = 57
11. .005 x .005 = . 000025
12. 20 x 20 x 20 = 8,000
13. 1/4 x 1/4 x 1/4 = 1/64 or .015625
14. 10 x 10 x 10 x 10 = 10,000
15. 2 x 2 x 2 x 2 x 2 x 2 = 64

4B ANSWERS

1. 43
2. 58
3. 68
4. 79
5. 86
6. 98
7. 29.07
8. 3.16

4C ANSWERS

1. 9 x 13 = 117 sq. ft.

2. 3.5 x 2 = 7 sq. m.

3. 136 ÷ 17 = 8 inches

4. 4.5 x 2 = 9 sq. ft

5. 45.5 ÷ 5 = 9.1 cm.

6. 100 x 40 = 4,000 sq.yd

7. 5 x 4.5 = 22.5 sq. yds.

8. 32 x 20 = 640 sq. ft.

9. 400 sq.ft per gallon x 1.5 gals. = 600 sq. ft maximum ÷ 8 ft. high = 75 ft. long

10. 11 x 8.5 = 93.5 sq. inches, which is less than 100 sq. in. ANSWER: NO

11. 2.25 x 4 = 9 sq. ft.

12. 6,000 ÷ 120 = 50 meters wide

4D Complex Areas ANSWERS

1. A = 192 sq ft

possible methods:

11 x 12 = 132

4 x 15 = 60

together 192

2. A = 261 sq ft

possible methods:

15 x 12 = 180

9 x 9 = 81

together 261

3. How many square feet of wallpaper will be needed to cover the wall pictured below?

entire room 8 x 11 = 88 sq. ft.

door 3 x 7 = 21 sq. ft.

wallpaper 88 - 21 = 67 sq. ft.

4. How many square feet of the warehouse can be used for storage?

entire floor space 47 x 84 = 3948 sq. ft.

space for office 15 x 20 = 300 sq. ft.

storage space left 3948 - 300 = 3648 sq. ft.

5. A = 304.5 sq. ft.
(Hint: This shape involves a rectangle and a triangle.)

area of house 10 x 21 = 210

area of triangle 1/2 x 21 x 9 = 94.5

area of both 210 + 94.5 = 304.5

6. A = 328.93 sq. ft.
(Hint: This shape involves a rectangle and a half of a circle.)

area of rectangle 14 x 18 = 252 sq ft

area of half circle is 1/2 x 3.14 x 7 x 7 = 76.93

area of both 252 + 76.93 = 328.93

7. The Port wants to put asphalt around a circular holding tank. How many square feet of asphalt will be needed?

area of square is 20 x 20 = 400 sq. ft.

area of circle is 3.14 x 7 x 7 = 153.86 or 154

400 - 154 = 246 sq. ft.

8. A container repairman wants to cut a circular piece from a square piece of steel. How many square centimeters of steel will not be used?

area of square is 14 x 14 = 196 sq cm.

area of circle is 3.14 x 7 x 7 = 153.86 or 154

area not used is 196 - 154 = 42 sq. cm.

9. There are 2 triangular shapes with flowers in the Port parking area. Excluding the garden area, how many square feet of parking does the area cover?

area total is 300 x 50 = 15,000 sq. ft.

area of triangle is 1/2 x 5 x 4 = 10
there are 2 triangles, so 20 sq. ft. used

area available is 15,500 - 20 = 14,980 sq. ft.

4E ANSWERS

1. 144

2. 3

3. 9

4. 3

5. 9

6. 36

7. 4840

8. 1/40 or .025

9. 70 x 30 = 2100 ÷ 9 = 233.33 sq. yds.

10. 3.25 x 1.5 = 4.875 x 4.50 = $21.9375 rounded to $21.94

11. 18 x 14 = 252 ÷ 9 = 28 sq. yds. x $10.50 = $294.00

12. 9 x 12 = 108 x .40 = $43.20

13. 13 x 16 = 208 minus 108 (from previous problems) = 100 sq. feet

14. 54 x 42 = 2268 ÷ 9 = 252 sq. yds. x $10 = $2520.00

4F ANSWERS

1. 4 x 4 x 4 = 64

2. 3 x 5 x 3 = 45

3. 3 x 3 x 3 = 27

4. 2 x 3 x 7 = 42

5. (1 x 3 x 3 = 9) + (2 x 3 x 1 = 6) = 15

6. 8 + 8 + 4 = 20

4G ANSWERS

1. 7 x 7 x 7 = 343 cu. in.

2. 3 x 3 x 3 = 27 cu. cm.

3. 8 x 8 x 8 = 512 cu. yds.

4. 0.5 x 0.5 x 0.5 = .125 and 18 x 18 x 18 = 5832

5832 ÷ .125 = 46,656 containers

5. 500,000 x 42 = 21,000,000 cu. ft.

6. 40 x 20 x 8 = 6400 x 425 = 2,720,000 cu. ft.

7. 45 x 45 x 45 = 91,125 x 215 = 19,591,875 cu. ft.

8. 6 x 4 x 3 = 72 and 24 x 54 x 30 = 38,880

38,880 ÷ 72 = 540 Roladexes

9. 7.66 x 19.33 x 7.83 = 1159.37 x 8 = about 9,274.97 cu. ft. using decimals

using fractions, it would be 1161 2/27 x 8 = 9288 16/27

10. 37.71 x 7.29 x 7.13 = 1960.08 and 3 x 3 x 3 = 27

1960.08 ÷ 27 = 72.6 cu. yds.

Answers 5A Pythagorean Theorem

1. $6^2 + 8^2 = 100$, $c = \sqrt{100} = 10$ ANS. 10 feet

2. $12^2 + b^2 = 15^2$, $225 - 144 = 81$, $b = \sqrt{81} = 9$ ANS. 9 inches

3. $5^2 + 12^2 = 169$, $c = \sqrt{169} = 13$ ANS. 13 yards

4. $8^2 + b^2 = 17^2$, $289 - 64 = 225$, $b = \sqrt{225} = 15$ ANS. 15 feet

5. $5^2 + 7^2 = c^2$, $c = \sqrt{74} = 8.6$ ANS. 8.6 ft or 9 ft. rounded off

6. $7^2 + 10^2 = c^2$, $c = \sqrt{149} = 12.2$ ANS. approximately 12 miles

Answers 5B - Pythagorean Theorem

1. $64^2 + 77^2 = c^2$, $c = \sqrt{10{,}025} = 100.12$ ANS. about 100 ft.

2. $24^2 + 38^2 = c^2$, $c = \sqrt{2020} = 44.9$ ANS. about 45 miles

3. $16^2 + 43^2 = c^2$, $c = \sqrt{2105} = 45.88$ ANS. about 46 feet

4. $120^2 + 154^2 = c^2$, $c = \sqrt{38{,}116} = 195.233$ ANS. 195 cm.

5. $19^2 + b^2 = 32^2$, $1024 - 361 = 663$, $\sqrt{663} = 25.748$ ANS. 26 hours

6. $60^2 + 40^2 = c^2$, $c = \sqrt{5200} = 72.11$ ANS. 72 miles so NO

7. $56^2 + 85^2 = c^2$, $c = \sqrt{10361} = 101.788$ ANS. 102 feet of pipe

Answers 5C - Mixed Problems

1. $15^2 + 25^2 = c^2$, $c = \sqrt{850} = 29.15$ **ANS. approx. 29 ft.**

2. A = LW, so 400 = L x 8, missing length is 50 ft. per gallon of paint,
   50 x 3 = 150 **ANS. 150 feet can be painted**

3. V = LWH, so volume of truck is 25 x 10 x 8 = 2000 cubic feet,
   volume of boxes is 4 ft x 2 ft x 1 ft (changed from inches) = 8 cu. ft.
   2000 ÷ 8 = 250 **ANS. 250 boxes**

4. A = LW = 30 x 9 = 270 sq. ft. for patio
   A = 1/2 BH for garden = 0.5 x 15 x 30 = 225 sq. ft. for garden
   $\frac{270}{225} = \frac{6}{5}$ **ANS. ratio is 6 to 5**

5. area of whole yard = 45 x 60 = 2700; area of patio = 270 (see above)
   $\frac{270}{2700} = \frac{x}{100}$, so x = 10 **ANS. 10 %**

6. garden area = 225; patio area = 270; shed area = 5 x 6 = 30 sq. ft.
   225 + 270 + 30 = 525 sq. ft. WITHOUT grass
   2700 (area of whole yard) - 525 = 2175 sq. ft. in grass
   ANS. 2175 sq. ft.

7. V = LWH, so 5 x 6 x 2/3 (because 8 inches is 2/3 of a foot) = 20 cu ft.
   20 cu. ft. x 7.5 gallons per cubic foot = 150
   ANS. 150 cu. ft. of water

8. V = 65 x 100 x 55 = 357,500 cu. cm. which is
   357,500 ÷ (100 x 100 x 100) = .3575 cubic meters
   .3575 x 86 x 4.25 = $130.666 **ANS. $130.67 for shipping**

9. V = 12 x 12 x 12 = 1728 cubic centimeters for packing boxes
   V = 1 x 1 x 1 = 1 for sugar cube
   1728 ÷ 1 = 1728 cubes per box **ANS. 1728 sugar cubes**

10. area of square = 8.5 x 8.5 = 72.25 sq. m.
    area of rectangle = LW = 72.25 = which is 18 x ?
    72.25 ÷ 18 = 4.01388 **ANS. side is about 4 meters wide**

6A Metric ANSWERS

Try using the prefixes to help you to fill in the blanks.

1. A kiloliter equals 1,000 liters.
2. A dekameter equals 10 meters.
3. A centigram equals 1/100 or .01 of a gram.
4. A millimeter equals 1/1000 or .001 of a meter.
5. A hectoliter equals 100 liters.
6. A decimeter equals 1/10 or .1 of a meter.
7. A kilogram equals 1,000 grams.
8. A milliliter equals 1/1000 or .001 of a liter.
9. A dekagram equals 10 grams.
10. A centimeter equals 1/100 or .01 of a meter.

Metric Answers 6C

Try these using the table for U.S. Standard Measurements

1. 4 quarts = 8 pints
2. 5 gallons = 20 quarts
3. 300 minutes = 18,000 seconds
4. 5 hours = 300 minutes
5. 6 days = 144 hours
6. 6 weeks = 42 days
7. 4 years = 208 weeks
8. 2 years = 730 days
9. 10 feet = 120 inches
10. 15 yards = 45 feet
11. 10 miles = 52,800 feet
12. 16 pints = 8 quarts
13. 12 quarts = 3 gallons
14. 300 seconds = 5 minutes
15. 150 minutes = 2 ½ hours
16. 54 hours = 2 ¼ days
17. 22 days = 3 1/7 or 3.14 weeks
18. 500 days = 1.37 years
19. 30 inches = 2.5 feet
20. 36 feet = 12 yards
21. 2640 feet = ½ or .5 miles

Metric Answers 6D

Part I

1. 5 m = 500 cm
2. 4 dm = .4 m
3. 24 dm = 2.4 m
4. 150 dm = 1.5 dkm
5. 7 km = 70 hm
6. 600 cm = 6 m
7. 3 hm = 30 dkm
8. 3 m = 30 dm
9. 70 cm = 7 dm
10. 300 hm = 30 km
11. 2 km = 200 dkm
12. 1.5 km = 1,500 m
13. 50 cm = 500 mm
14. 1 m = 1,000 mm
15. 2,000 mm = 2 m

Part II

1. 30 cg = 3 dg
2. 6 kg = 6,000 g
3. 400 mg = 4 dg

4. 5 kg = 50 hg

5. 500 dg = 50 g

6. 850 dkg = 8.5 kg

7. 14 g = 1400 cg

8. 56 hg = 5.6 kg

9. 4 kg = 400 dkg

10. 5.25 kg = 5250 g

Part III

1. 50 cl = 5 dl

2. 250 ml = 25 cl

3. 1,600 cl = 16 l

4. 25 dkl = 250 l

5. 43 hl = 4300 l

6. 3 kl = 300 dkl

7. 6,500 l = 6.5 kl

8. 7 dl = 700 ml

9. 20,000 l = 200,000 dl

10. 5.5 l = 5500 ml (please note this does NOT say 5.51)

STUDENT ACTIVITY 7A -ANSWERS
METRIC CONVERSIONS

Directions: Convert these measurements using the chart above. You may use a calculator. Round off the answer to a whole number.

1. 2.65 ft = 81 cm
2. 34.5 in = 88 cm
3. 419 qt = 396 l
4. 97 pt = 46 l
5. 14.75 oz = 418 g
6. 5.7 lb = 2,586 g
7. 1500 m = 1640 yd
8. 528 cm = 17 ft
9. 22 l = 6 gal
10. 183 l = 193 qt
11. 546.7 g = 1 lb
12. 325.8 g = 12 oz

STUDENT ACTIVITY 7B
METRIC CONVERSIONS ANSWERS

Directions: Convert each measurement and round the answers to two decimal places.

1. 14 in = 35.56 cm
2. 40 km = 24.86 mi
3. 100 lb = 45.36 kg
4. 6 l = 6.34 qt
5. 3.2 oz = 90.72 g
6. 140 cm = 55.12 in
7. 8 mi = 12.87 km
8. 27 l = 7.13 gal
9. 50 in = 1.27 m
10. 920 g = 2.03 lb
11. 90 ft = 27.43 m
12. 200 m = 656.16 ft
13. 106 qt = 100.31 l
14. 454 g = 16.03 oz
15. 3.61 lb= 1637.50 g
16. 500 kg = 1,102.3 lb
17 40 qt = 37.85 l
18. 7.25 m = 285.43 in
19. 400 lb = 181.44 kg
20. 8 oz = 226.8 g
21. 15 l = 15.85 qt
22. 8 gal = 30.28 l
23. 80 m = 262.46 ft
24. 330 g = 11.65 oz
25. 36 ft = 10.97 m
26. 3.7 m = 145.67 in
27. 289 km = 179.58 mi
28. 72 in = 182.88 cm
29. 935 cm = 30.68 ft
30. 12 l = 25.36 pt

31. In 1993 general cargo moving through five marine terminals in Baltimore increased to 5,423,471 short tons. How many metric tons was this?
4;881, 123.9 m

32. Six boxes occupy 1.2 square meters each. How many square yards is this for all 6 boxes? **8.64 sq. yds.**

33. Cars that are ready for export must be moved 800 meters to the ship. How many miles is this to the nearest tenth?
.5 mi.

34. The U.S. legal gross weight limit on a 40 foot container is 80,000 lbs. The tractor, empty container, and chassis weigh 33,000 lbs. If a shipment is 21,152 kg, will it be within the weight limit?
46,631.699 pounds, yes

35. An imported car from Japan has a gas tank with a 52 liter capacity. How many gallons of gas will the tank hold?
13.7384 gal

36. Conowingo Dam on the Susquehanna River is 14 miles upstream from the Bay. How many kilometers is that?
22.5302 km

37. A ship unloads 75 metric tons of iron ore. This is how many short tons?
82.5 tons

38. 1.8 million metric tons of fish are harvested annually in water within three miles of the coast. How many pounds is this?
3,967,200,000 pounds

39. If a warehouse has 20 foot high ceilings, and a piece of machinery needs to be stored that is 6 meters high, will it fit?
19.6848 feet, yes

40. A forklift has a 35,000 pound capacity. Will a driver be able to move a 15,242 kilogram container with it?
33,602.513 pounds, yes

Metric Word Problems 7C- ANSWERS

1. Company 1 is shipping 4500 pineapples. 2000 weigh 20 ounces each, 500 weigh 25 ounces each, and 2000 weigh 32 ounces each. What is the weight of the shipment in kilograms?

one solution:

2000 x 20 x 28.3495 = 1,133,980 grams ÷ 1000 = 1133.98 kilograms
500 x 25 x 28.3495 = 354368.75 grams ÷ 1000 = 354.37 kilograms
2000 x 32 x 28.3495 = 1,824,368 grams ÷ 1000 = 1814.37 kilograms
1133.98 + 354.37 + 1814.37 = **3302.72 kg or 3303 kilograms**

another method:

2000 x 20 = 40000
500 x 25 = 12500
2000 x 32 = 64000
TOTAL 116,500 x 28.3495 =3302716.7 ÷ 1000 = 3302.7 kg or 3303 kilograms

2. Company 2 is shipping 100,000 ounces of mushrooms, drained. What is the weight of the shipment in kilograms?

100,000 x 28.3495 ÷ 1000 = **2834.95 kg**

3. Company 3 is shipping 40,000 gallons of Miller's Lite Beer.

A. How many ounces is this?
B. How many liters?
C. If each gallon weighs 10.75 pounds, what is the weight of the shipment in pounds?
D. What is the weight in kilograms?

A. to find the number of ounces in a gallon multiply 16 oz/pt x 2 x 4 = 128 oz/gal
128 x 40,000 = **5,120,000 ounces**

B. 40,000 gal x 3.7853 = **151,412 liters**

C. 40,000 x 10.75 lbs = **430,000 pounds**

D. use 430,000 from part C, multiply by .453592 = **195,044.56 kilograms**

4. Company 4 ships 400 sheets of glass that are 6 feet x 8 feet each. How many square meters are in this shipment?

6 x 8 = 48 sq. ft. x 400 = 19,200 sq. ft. x .0929 = **1783.68 square meters**

5. Company 5 has a shipment of 20 panels that are 600mm x 200mm x 20mm each.
   A. What do all the panels total in cubic meters?
   B. If the inside dimensions of the container are 7.6 feet x 7.6 feet x 39.5 feet, will the 20 panels fit in the container?

A. 600 mm x 200 mm x 20 mm = 2,400,000 ÷ 1000 ÷ 1000 ÷ 1000 = .0024 cu m
OR
600 ÷ 100 = .6 m and 200 ÷ 1000 = .2 m and 20 ÷ 1000 = .02 m
so .6 x .2 x .02 = .0024 cubic meters
.0024 x 20 = **.048 cu. m**

B. 7.6 x 7.6 x 39.5 = 2281.52 cu. ft.
2281.52 x .0283168 = 64.6053 cu. meters
so the panels from part A **will fit** inside the container

6. Company 6 is shipping 500 boxes of Ritzo, which each measure 3 feet on each side. What is the volume of the boxes in meters? What is the volume in centimeters?

3 x 3 x 3 = 27 cu. ft. x 500 = 13,500 x .0283168 = **382.2768 cubic meters**

one meter equals 100 centimeters, so a cubic meter is
100 x 100 x 100 = 1,000,000 cu. cm. x 382.2768 = **382,276,800 cu. cm.**

7. Company 7 ships 1000 boxes of Brand X wine, each containing 150 liters.
   A. The IRS wants to know how many gallons this is.
   B. The tariff schedule charges a $10 tariff per 1,000 liters. What is the charge for this shipment?

A. 1000 x 150 = 150,000 liters x .2642 = **39,630 gallons**

B. 150,000 liters from part A ÷ 1000 = 150 x $10 per 1000 = **$1,500**

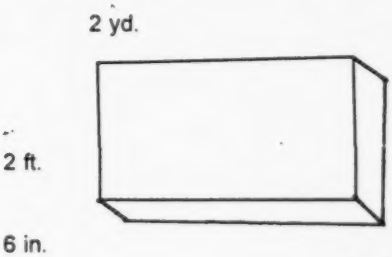
8 - POST-ASSESSMENT ANSWERS

1. An answering machine was 15% off in a sale. If the original price was $69.99, what was the sale price of the machine? What was the final price if the tax in this state was 5%? (2 answers needed)

$\frac{x}{\$69.99} = \frac{15}{100}$ $\quad x = \$10.50$

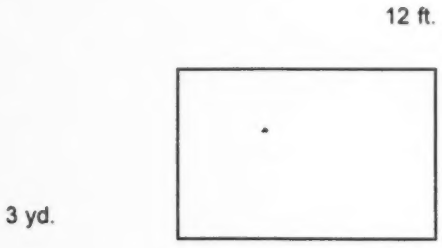
so sale price is 69.99 — 10.50 = **$59.49**
and 5% tax on 59.59 is $2.97, so final price is **$62.46**

2. What is the volume of the box below in cubic feet?



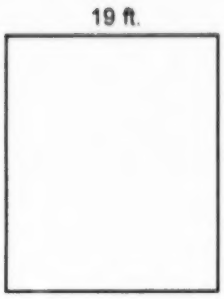
2 yd = 6 ft, 6 in = 1/2 foot, so 6 x 2 x 1/2 = **6 cu ft**

3. The cost of the tile to cover this floor is $16.50 per square foot. How much will a new floor cost?



3 yards = 9 feet, so 12 x 9 = 108 sq. ft. x $16.50 = **$1,782.00**

4. What is the diagonal of this rectangle to the nearest whole number?



$19^2 + 13^2 = c^2$ so 361 + 169 = 530, $\sqrt{530}$ = **23.02 feet**

5. A shipment is priced at $.50 per pound. If 2,500 kilos need to be sent, what will this shipment cost? (kilogram to pounds, multiply by 2.2046)

2500 x 2.2046 x .50 = **$2755.75**

6. A shipment is 500 square meters in size. The truck used to transport it is measured in feet. What is the size of the shipment in square feet? (square meters to square feet, multiply by 10.7636)

500 x 10.7636 = **5381.8 sq. ft.**

7. Company Q is sending item A valued at $400, item B valued at $600, and item C valued at $500. If the company is given a $200 rebate, how will the company reassign the cost to items A, B, and C to keep the prices proportional?

first add 400 + 600 + 500 = 1500
then subtract 200 from 1500 = 1300, new total

A $\frac{400}{1500} = \frac{x}{1300}$ Item A becomes **346.67**

B $\frac{600}{1500} = \frac{x}{1300}$ Item B becomes **520.00**

C $\frac{500}{1500} = \frac{x}{1300}$ Item C becomes **433.33**

All three items add up to $1300.00.